

**The impact of exercise on self-esteem, anxiety, and depression on first-year
students at the University of Venda**

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Submitted in fulfilment of the requirements for the degree of

DOCTOR OF PHILOSOPHY

in

PSYCHOLOGY

In the

FACULTY OF HUMANITIES

(School of Social Sciences)

at the

UNIVERSITY OF LIMPOPO

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2021

DEDICATION

I dedicate this study to my son Khodani Lucky Tshikovhele Junior, my wife Millicent Kagiso Mokwena-Tshikovhele, My parents Esther and Gilbert Tshikovhele, my siblings (Thendo, Ofhani, Farananai and Sedzani Tshikovhele) and my late friend Khuthe Livhuwani.

DECLARATION

I declare that: **The impact of exercise on self-esteem, anxiety, and depression on first year students at the University of Venda**, is hereby submitted to the University of Limpopo, for the degree of Doctor of Philosophy in Psychology and has not been previously submitted by me for a degree at this or any other university; that it is my work in design and in execution, and that all material contained herein has been duly acknowledged.

Tshikovhele KL (Mr)

Date

ACKNOWLEDGEMENTS

I would like to spread my genuine appreciation to the following people for their incessant support and guidance:

- To my internal supervisor Prof S Govender and
- My external supervisor Prof K A Nel for their endless support and guidance from the beginning to the end.
- Prof A Meyer for her assistance with data analysis.
- All the students who participated in this study.

I would also like to extend my gratitude to the National Research Funding (NRF) for sponsoring this study.

ABSTRACT

Students who transition from school to tertiary institutions can experience stressors which lead to anxiety and depression. This can be alleviated by exercise. Limited research has been undertaken about exercise and the alleviation of depression amongst tertiary education students in South Africa. The aim of the study was to investigate the impact of exercise on depression, anxiety, and self-esteem on first-year students registered at the University of Venda (UNIVEN). A quantitative approach using a cross-sectional survey design was used. The study sample consisted of 320 randomly selected first-year students, 160 students who exercised regularly and 160 students who did not exercise at all. Data was collected using the Rosenberg Self-Esteem Scale (RSE), The Becks Anxiety Inventory (BAI), and the Becks Depression Inventory-11 (BDI-11). The study was theoretically underpinned by the trans-theoretical model (TTM). Data analysis used both non-inferential and inferential statistics that is, descriptive statistics, multivariate analysis of variance (MANOVA) and logistic regression analysis. The findings supported those found in previous research, both locally and internationally. The hypotheses of this study were fully supported by the results. Results pertaining to age and gender in this study revealed that there were no significant differences in scores. Additionally, respondents that had higher levels of anxiety, due to not exercising, were linked to pre-contemplation in the TTM. It was determined that these respondents were not aware of exercise as an intervention to enhance their overall well-being and mental health. Generally, the research contributes to understandings of the impact of exercise as an intervention in mental health challenges in first year tertiary education students. The exercise guidelines developed out of this research will help the Department of Education (DoE), UNIVEN and tertiary institutions generally in providing exercise interventions to undergraduate students in the tertiary education sector.

Keywords: Exercise, depression, anxiety, depression, exercise, and self-esteem

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GLOSSARY OF TERMS

AAHPERD - American Alliance for Health, Physical Education, Recreation and Dance

ANOVA-Analysis of Variance

APA – American Psychiatric Association

BAI-Becks Anxiety Inventory

BDD – Body Dysmorphic Disorder

BDI-11 - Becks Depression Inventory-11

BMI – Body Mass Index

B/P – Blood Pressure

CSEI - Coopersmith Self-Esteem Inventory (CSEI)

CVD – Cardiovascular Disease

DASS-21 – Depression Anxiety and Stress Scale - 21

DoE - Department of Education

DoH – Department of Health

DSM 5- Diagnostic and Statistical Manual of Mental Disorders-5

DQ – Demographic Questionnaire

EBBS - Exercise Benefits and Barriers Scale

EU- European Union

GAD- Generalized Anxiety Disorder

GADS - Generalised Anxiety Disorder Scale

GAPPA - Global Action Plan for Physical Activity (GAPPA)

GPA – Grade Point Average

GS – Grip Strength

HKE – Human Kinetics and Ergonomics

HPCSA- Health Professional Council of South Africa

HPA - Hypothalamic-pituitary-adrenal

HR -Heart Rate

IPAQ -International Physical Activity Questionnaire

LSQ - Life Satisfaction Questionnaire

MDD – Major Depressive Disorder

MHSQ - Mental Health Screening Questionnaire

NCDs – Non-Communicable Diseases

NMMU – Nelson Mandela Metropole University

OCD- Obsessive Compulsive Disorder

OR – Odds Ratio

PA – Physical Activity

PE - Physical Exercise

PHQ - Patient Health Questionnaire

PPE – Personal Protective Equipment

PSS – Perceived Stress Scale

PSQI - Pittsburgh Sleep Quality Index (PSQI)

PMR - Progressive Muscle Relaxation

PTSD - Post-Traumatic Stress Disorder

RSES-Rosenberg Self-Esteem Scale

SAD – Social Anxiety Disorder

SD-Standard Deviation

SHAPE - Society of Health and Physical Educators

TREC-Turfloop Research and Ethics Committee

TTM - Trans-Theoretical Model

UK – United Kingdom

UNIVEN - University of Venda

USA- United States of America

UWC – University of the Western Cape

WC – Waist Circumference

WHO - World Health Organisation

20MSRT – 20 Metre Shuttle Run Test

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CHAPTER 1

INTRODUCTION

1.1 Introduction to the study

This research considers the impact of exercise on self-esteem, anxiety, and depression on first year students at the University of Venda (UNIVEN). This chapter gives the general background to the study and discusses its purpose and significance.

1.2 Background of the study

The World Health Organization (WHO, 2021) reports that depression is the most widely diagnosed mental illness worldwide. It affects around 340 million individuals globally and occurs in every country. Considering that both depressive and anxiety related illnesses are the most common forms of psychological illness, every healthy solution to helping people live a fulfilled positive life is necessary (Zeng et al., 2019).

Regular exercise can be regarded as an effective tool with which to influence the psychological well-being of people (Hamidah et al., 2015; Zeng et al., 2019). According to these authors anxiety and self-esteem are amongst the most important psychological factors affecting tertiary education students. Nel and Tshikovhele (2018) conducted research on a non-proportional quota sample of 30 students who exercised regularly and 30 students who did not exercise regularly. They focused on the impact physical activity had on the students' reported levels of psychological well-being and depression. Data were collected using two standardised questionnaires. Results revealed that positive psychological well-being was higher in students who exercised frequently, while those who did not take part in any exercise at all reported a more negative wellness profile. There were no significant differences, in this research, between non-regular exercisers and regular exercisers in terms of reporting

depression. However, females who participated in exercise showed an optimistic psychological well-being as compared to males ($p=0.001$). This was a significant result.

Sharma et al. (2012) report that one of the factors in obesity is a lack of exercise. These researchers carried out a study to assess the impact of physical exercise on Body Mass Index (BMI) and self-esteem on obese people in an urban slum in Mumbai, India. The research was conducted at a clinic for preventative and social medicine situated in the slum. There were a total of 360 respondents. Sixty-four percent (64%) of the obese respondents in the study were female. The data were collected by face-to-face interviews and questionnaires. People suffering from obesity reported high blood pressure (B/P) and uncontrollable blood sugar resulting in Diabetes-11. Other results revealed that just over 14% of respondents had low self-esteem, which was more common in females by 70%. People that had high self-esteem had a BMI of less than 25 and were not obese. Findings suggested that individuals who are obese are likely to develop mental health difficulties, including Body Dysmorphic Disorder (BDD) and depression. The authors concluded that people need to be properly educated on the effects of obesity and should be encouraged to exercise more. These findings were supported by Luhar et al. (2020) who hypothesize that obesity will double in adults, including tertiary education students, between 2010 and 2040.

According to Linde (2014) and Cahuas et al. (2020), depression is a negative factor in every-day life and impacts on all areas of the physical and cognitive make-up of an individual. Moreover, depression is likely to affect every person at least once in their lives. This is due to a combination of environmental, genetic, biological, and psychological factors which can give rise to depression for example, the loss of a loved one, stress from work or losing a job, any kind of trauma, a difficult personal relationship and/ or moving to a new location. The aforementioned factors can all trigger a depressive episode. Most doctors or psychiatrists will look at anti-depressive therapy in the form of drugs, psychotherapy, support

groups, or lifestyle/behavioural modifications in order to help patients diagnosed with depressive symptomology.

Depression was reported as likely to become the most life-threatening cause of incapacity worldwide in the next decade (Serretti, & Porcelli, 2018). According to Krogh et al. (2011), research using rigorous designs and random samples has found that exercise has improved all types of depression both severe and mild. It was also noted that using 'green' prescriptions like exercise, is cheaper and less invasive than pharmacological interventions, with fewer or no serious side effects which is supported by research by Perry et al. (2020). Other research findings which support this assertion reveal that non-professional exercise routines are as effective as work-out programmes designed by professional trainers in lessening depression (Callaghan et al., 2011; Pickett et al., 2017).

Morgan et al. (2013) and Halliday et al. (2019) suggest that depressive illnesses are being reported more frequently on the global stage and that physical activity and exercise should be used, where possible, as other treatments are expensive and have side-effects. The WHO (2021) report that depressive illnesses are often comorbid with other stress and anxiety related disorders. The report revealed that exercise had as much (and sometimes more) efficacy in treating depressive disorders than pharmacological interventions. This was also found in a survey conducted in the European Union (EU) by The Mental Health Foundation (2016). In this study it was found that depressive illnesses were on the rise and many respondents self-reported symptomology associated with Post Traumatic Stress Disorder (PTSD); depression; Generalised Anxiety Disorder (GAD) and other mental illness associated with stress and anxiety.

A randomised controlled trial which involved 156 adults who suffered depression compared three groups that: 1) used medication; 2) used medication and exercise and 3) used exercise alone. There were significant results for all the groups in terms of showing less depression. Statistical procedures between the three groups revealed no statistically significant differences in how the respondents reacted to the interventions. However, the group that used only medication had a quicker positive reaction to treatment in the initial month the medication was started (Carek et al., 2011). On a similar note, another study found that exercise reduced depressive symptoms, with reduction rates of 45% in an exercising group that was supervised, 40% in an exercise group that was home-based and 47% in a group that was taking medication. Additionally, depressive symptoms showed improvements when exercise was added to a medication regime. In another study exercise significantly improved depressive symptomology, when used with medication, in an elderly sample where psychopharmacology alone had not worked (Brammer, 2018).

1.3 Research rationale

In South Africa no research on the link between, exercise and self-esteem, anxiety and depression had been explored. Studies were conducted by Sikhwari (2007) that examined the association between academic achievement and the affective factors of students registered at the University of Venda (UNIVEN). The results of this investigation indicated that motivation, attitude, and self-concept were a major factor in students' ability to achieve academically. It was also noted that emotional factors cannot be preserved as distinct units but that they are interdependent with cognitive ones. These findings were supported by Khalid et al. (2021) in research undertaken in the United States of America (USA). Additionally, Sikhwari (2007) recommended that further research should be conducted regarding the association between affective factors, such as self-concept and student's academic achievements.

Furthermore, Kim et al. (2021) in research in Korea, stated that it is important to conduct research in tertiary institutions looking at how physical exercise impacts on students' overall health and wellbeing. Limited research was undertaken at the University of Limpopo on the effect of exercise on depression with a small sample (Tshikovhele, 2015; Nel & Tshikovhele, 2018). The aforementioned research found that exercise did lessens symptoms of depression and impacted on student well-being in a positive manner. These authors state that previous studies in the field focused mainly on the impact and influence of exercise on depression, non-communicable diseases and psychological well-being but did not consider self-esteem and anxiety. The link between stress, self-esteem, exercise, and anxiety had thus not been explored in a South African context, which makes the present study unique. The study was undertaken at UNIVEN so as to widen the scope of this type of research and to ensure that different institutional populations and ethnic groups were sampled (At UNIVEN the population is mostly Venda while at the University of Limpopo it is mostly Pedi).

This study also expanded on Tshikovhele's (2015) research by investigating the influence of exercise on self-esteem, anxiety, and depression at a semi-rural university, namely UNIVEN. The present research is therefore unique as it offers a better understanding of the impact of exercise on the mental health functions of first-year university students. First year students are exposed to more stress and anxiety than other levels of study as it is often their first time away from home. They also have to get used to the institutional environment which expects students to work in their own time unlike in the school environment where their work is checked on a daily basis (Hassel & Ridout, 2018). Moreover, the researcher decided to update any existing guidelines for exercise amongst first year students if they existed, to ensure there was a practical application to the study. As none were found the researcher developed exercise guidelines for first year students which added another unique contribution to the study. It is envisaged that these guidelines, which can be developed and

expanded, will help university administrators, mental health professionals and exercise and coaching practitioners at UNIVEN, and other institutions, in promoting and creating exercise strategies for both physical and psychological well-being.

1.4 Aim of the study

The aim of the study was to investigate the impact of exercise on depression, anxiety, and self-esteem on first-year students registered at the University of Venda.

1.5 Objectives of the study

- To determine whether first-year students who exercise regularly have more positive self-esteem than students who do not engage in exercise regularly at UNIVEN.
- To establish whether first-year students who engage in exercise on a regular basis display less indicators of depression than those who do not engage in exercise regularly at UNIVEN.
- To find out whether first-year students who exercise regularly have less symptoms of anxiety than those who are non-regular exercisers at UNIVEN.
- To update any existing guidelines for exercise at UNIVEN and/or produce a set of guidelines for exercise at the institution.

1.6 Hypotheses for the study

Ho1: Students who exercise regularly have more positive self-esteem than students who do not exercise regularly.

Ho2: Students who exercise regularly have fewer depressive indicators than students who do not exercise regularly.

Ho3: Students who exercise regularly have less anxiety symptoms than students who do not exercise regularly.

1.7 Operational definitions

The following operational definitions were used in this research.

- **Physical exercise (PE)**

It must be noted that physical activity (PA) can be any form of activity, such as working (physically) in the house, and is not the same as physical exercise thus no definition is given for PA, as it is not a variable used in this research. However, it may be seen in some of the literature which includes both physical exercise (PE) and physical activity (PA) as variables. It is also true that some researchers use the terms interchangeably (Cohlberg et al., 2016).

According to the WHO (2021), exercise is defined as any physical movement or bodily movement delivered by skeletal muscles that requires energy consumption. This happens in both in-direct and vigorous-intensity physical activity. Exercise is defined as activities that are arranged and intentional which attempt to improve an individual's overall well-being and health. In this study, regular exercise refers to any physical exercise/activity which was undertaken on a regular basis that is, three times a week for thirty minutes, over a period of two months or more. Non-regular exercise refers to those who do not exercise at all (Nel & Tshikovhele, 2018).

- **Depression**

Clinical depression is often diagnosed as Major Depressive Disorder (MDD). This is characterised by the Diagnostic and Statistical Manual of Mental Disorders or the DSM-5 (American Psychiatric Association [APA], 2013) as consisting of symptoms related to low mood and loss of interest in regular activities that are present for most of the day over at least a 2-week period. Salari et.al. (2020) report that globally, depression has the highest predominance of all psychological/psychiatric illnesses.

In this study, depression will refer to symptoms screened by the Becks Depression Inventory-11 (BDI-11). See page 68, sub-heading 4.6.2.

- **Non-Clinical Depression**

Non-clinical depression is not a recognised mental illness however, it exists. In this study it is characterised as negative responses to questions on the BDI-11 inventory. These responses show participants experience anxiety and stress resulting in mild depression which can result in challenges in day-to-day living. Non-clinical depression is not usually treated but it can, overtime, become clinical depression (Paniccia et al., 2017).

- **Anxiety**

Anxiety is a response to a threat that is unknown, internal, vague, or conflictual (Sadock & Sadock, 2007). Anxiety disorders, according to the DSM-5 (APA, 2013), include panic disorders (characterised by frequent panic attacks, somatic and autonomic indications of fear); generalised anxiety disorder (prolonged anxiety accompanied with overpowering, extreme worry about nominal and significant matters alike); phobic disorders (which include agoraphobia which is an irrational, uncontrollable fear of an object or situation); post-traumatic stress disorder (PTSD which is characterised by intrusive, unpleasant thoughts of the trauma the individual experienced; and obsessive compulsive disorder (OCD) which focuses on irrepressible thoughts, imagery or actions.

In this study anxiety as defined by Beck et al. (1988) and Matheson et al. (2020) is adopted namely, a complex cognitive, affective, physiological, and behavioural response system that is activated when anticipated events or circumstances are perceived as highly aversive. They are seen as unpredictable and uncontrollable events that could potentially threaten the vital interests of an individual. This type of event is common amongst

individuals for instance, students who are adjusting to a new social environment and preparing for exams or tests (Howard, 2020).

- **Self-esteem**

According to Rosenberg (1965) and Park and Park (2019), self-esteem is an individual's positive or negative attitudes towards themselves and their overall evaluation of their thoughts and feelings in relation to a specific situation. Self-esteem is regarded as personal psychological characteristics relating to self-judgments based on an individual's values.

Zeng et al. (2019) state that self-esteem is characterised as a measurement of self-value based on individual success. Additionally, self-esteem can be a combination of self-respect and self-confidence that stimulates self-motivation in an individual in order to reach a specific goal. In this study, the concept self-esteem is used in explaining or describing the way first-year students behave, respond, interact, and perceive themselves when faced with any social challenges they experienced at UNIVEN.

Self-efficacy, which is not a variable in this research, is slightly different in that it is the realistic notion an individual has of his or her ability to do well in life by completing specific goals. Self-efficacy refers to the individual's confidence in their own ability to control their behaviours and social environment (Bandura, 1997).

1.8 Significance of the study

Very little research has been carried out on the effect of exercise on a previously disadvantaged student population, only one could be found in Limpopo Province at the University of Limpopo (Tshikovhele, 2015). The present research is seen as a significant addition to research in this area as it added to the small data base of existing studies in South Africa on understanding the impact of exercise on the mental health of first year students. It

is hoped that the findings will help not only UNIVEN, but other institutions, in terms of formulating guidelines and interventions in terms of exercise and mental health promotion in rural (and urban) areas in South Africa. A prospective set of guidelines for physical exercise for students, which makes the study unique, was formulated which could also be used at other year levels and in other institutions.

1.9 Summary

This chapter presented the motivation for the present research including the background to the study, the research rationale, its aims and objectives and the study significance. Chapter 2 presents the theoretical framework which underpins the investigation.

CHAPTER 2

THEORETICAL FRAMEWORK

2.1 Introduction

Chapter 2 presents the theoretical framework that was used to underpin the study. This is the trans-theoretical model (TTM) as developed by Prochaska and Velicer (1997). The TTM was originally developed as a means for understanding how individuals change or adapt to health-risk behaviours. It arose from the systematic review and empirical testing of more than 150 behavioural theories (Hashemzadeh et al., 2019; Prochaska & Velicer, 1997) and, as such, was considered appropriate for use in this research which looks at exercise behaviours.

2.2 The role of theory in this research: the Trans-Theoretical Model (TTM)

The TTM is aimed at understanding an individual's attempts at behaviour change describing how they move dynamically through the five different stages the model proposes. The TTM has been widely used to describe and understand exercise behaviour, such as the adoption and maintenance of exercise regimes (Han et al., 2017). As it is a model that encourages behaviour change for instance, when setting physical activity goals, it can be used to underpin and develop exercise guidelines (Woods, Mutrie & Scott, 2002). In this research it was used as a theoretical basis to underpin the research and to underpin the development of exercise guidelines for first year students.

A key feature of TTM is the stage that conceptualises behaviour change for instance, how people stop smoking, both self-initiated and/or with professional help. For the purposes of this study, the theory will be focused on students and their exercise regimes (or lack of them) and how these impact on their self-reported depression, anxiety, and self-esteem. The TTM views the health risk behaviour change process as occurring over five stages namely, pre-contemplation, contemplation, preparation, action, and maintenance. These stages are

methodical and associated with decisional balance, self-efficacy, temptation, and the process of behaviour change that is either predictable or unique (Hashemzadeh et al., 2019).

Decisional balance refers to the way an individual weighs up the positive and negative behavioural consequences of selecting and adopting a new exercise behaviour (Prochaska & Velicer, 1998).

According to the TTM, these stages are dynamic and inter-changeable (Friman et al., 2017; Prochaska & Velicer, 1997). The first stage, pre-contemplation (or not ready yet) in this research, is characterised by having no intentions of exercising within the next six months (Hashemzadeh et al., 2019; Prochaska & Velicer, 1997). Sedentary individuals at this stage are unaware of problems associated with obesity and lack of exercise and are often labelled as resistant, or not-motivated to change by traditional intervention programmes (Chamberlain et al., 2017; Prochaska & Velicer, 1997). The individual in the pre-contemplation phase is not likely to act in the foreseeable future which is defined as a period of 6 months.

The second stage is contemplation (or getting ready). This stage shows a progression in that the individual acknowledges the problem however, they have not yet made any commitments to changing their actions or behaviour (Hashemzadeh et al., 2019).

Contemplation is the phase in which individuals state they will change their negative behaviour within the next 6-months. They are alert to the benefits of changing the negative behaviour but are aware of the costs, or problems they might incur when trying to change it. This weighing of the positives and negatives (decisional balance) produces uncertainty that can cause the individual to remain in this phase for long periods of time (Alidosti et al., 2017).

Decisional balance refers to the weighing of the positives and negatives (pros and cons) which is particularly important during the contemplation stage. Individuals often experience ambivalence about which course of action to take (Chamberlain et al., 2017). An individual is likely to go through several cycles of pre-contemplation, contemplation, and preparation before engaging in any action, and may regress from one stage to an earlier stage (Prochaska & Velicer, 1997). This is in-keeping with research that suggests that for instance, smokers may make three or four attempts at acting (stopping smoking) before proceeding to maintaining this change for any length of time. Hashemzadeh et al (2019) report that 93% of people who want to make behavioural changes will fall back into their previous lifestyle within a year. The issue of relapse constitutes an important component of the TTM and relates to the health promotion concept of harm reduction. Essentially, the conceptualisation stage of behaviour modification proposed by the TTM is motivated by the realisation that the complete abstinence of a health-risk behaviour may not be a realistic goal (at least not in the short term), and a more realistic goal may be to move through the process gradually (Prochaska & Velicer, 1997).

Preparation (or readiness) is the next phase. In this phase individuals propose to act in the near or instant future, typically measured as in the next month. Characteristically, they have already taken some important actions towards behaviour change in the previous year and are determined to make changes. These individuals usually have a strategy in terms of behaviour change such as purchasing a gym membership and/or discussing the proposed behaviour change with their medical doctor (Alidosti et al., 2017).

Action is the phase in which individuals have made changes to their lifestyles during the past six months. However, re-lapse can occur after this phase which may cause the behaviour change to stop permanently. However, it is more likely to mean that the individual was not ready to make the behaviour change, and he or she will attempt it again after a period

of time. The cyclical process will then start again (See figure 1, p.15). After the action phase, if there is no relapse, maintenance occurs. This is the phase in which individuals have made alterations to their lifestyles and work to avoid slipping back into their old, in terms of this research, sedentary behaviours (Alidosti et al., 2017).

According to Kuan et al. (2019), self-efficacy is an individual's belief in their ability to organise and execute the course of action required to achieve any stated goal and to resist the temptation to relapse. Self-efficacy and self-esteem are important because individuals with high self-efficacy for tasks tend to try harder and experience more positive emotions related to the tasks thus are more successful at completing behaviour change. Individuals with higher self-efficacy and high levels of self-esteem also accept more challenges and persist with their appointed tasks despite obstacles. Moreover, the pros and cons in decisional balance refer to the perceived positive and negative aspects of modifying a behaviour. Individuals tend to adopt new behaviours when they find that the benefits outweigh the negatives. Additionally, processes of change are strategies that use cognitive and behavioural activities to modify experience and environment in order to change behaviour. Cognitive and behavioural processes during an individual's attempts to change behaviour are used to sustain these improvements in for instance, lifestyle and exercise changes.

Kuan et al. (2019) report that movement through the TTM stages often occurs in a cyclic rather than a linear pattern. This happens because many individuals make several attempts to change their behaviour before they achieve their goals and move on to the next stage. In moving through these stages, individuals use different strategies and techniques depending on their goals and motivations.

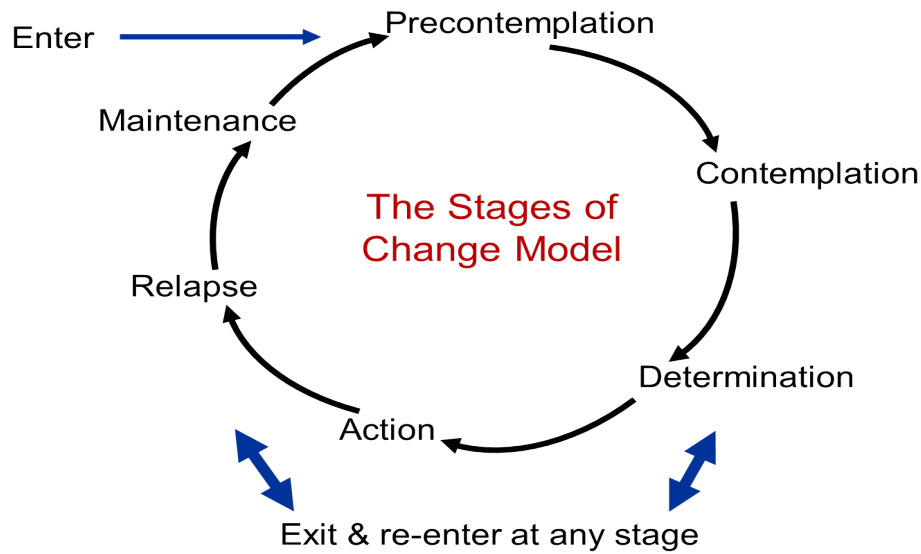


Figure 1: Cyclic pattern of behaviour change in the TTM (LaMorte, 2019).

2.2.1 Examples of using TTM in research studies on exercise behaviours

There were no studies looking at depression, anxiety, self-esteem, and exercise behaviour using the TTM at the time this research took place. However, the following studies used the TTM looking at exercise behaviours and one or more of the present study variables for instance depression and/or anxiety. These studies indicate how the TTM is used in an applied or practical manner in research.

A recent cross-sectional research study using the TTM was conducted by Kuan et al. (2019) with the purpose of examining the structural relationship of the TTM and the amount of exercise among undergraduate students in a medical university in Malaysia. This study was carried out amongst students who took part in a co-curricular programme. The co-curricular programme included activities that took place outside of the regular lectures or tutorials at the institution. Students recruited, through purposive sampling, were informed that their participation was entirely voluntarily. Those interested completed the self-administered questionnaire, which consisted of questions related to decisional balance, processes of change, self-efficacy, stages of change scales, and their exercise routines.

According to Kuan et al. (2019), a total of 562 undergraduate students (118 males and 444 female) participated in this study. All the eligible students were registered in the university's co-curricular programme which comprised of sports, arts, and other subjects not related to their degrees. Only the students who were available during the time of data collection, and who wanted to volunteer for the study, were recruited as participants. Results indicated that most of the sample were in the preparation stage of the TTM and did engage in some exercise, but not on a regular basis. It was also found that co-curricular activities facilitated students' engagement in exercise. Furthermore, if the student had friends and peers who engaged in exercise, they were more likely to exercise. Fundamentally, friend and peer support positively affected the sample by providing a supportive environment. Moreover, regularly scheduled exercise sessions, with company, were found to help students sustain healthier, active lifestyles. Students in the preparation stage, in this study were thus found likely to change their current exercise level into the action stage in a positive manner (more exercise).

Kuan et al. (2019) state that their study outcomes provided a new understanding of the current exercise stages of Malaysian university students. The findings indicated that, decisional balance, and processes of change influence the continuance of regular exercise among students dependent on their current stage of change. These results revealed that most of the sample were in the preparation stage of the TTM however, they were likely to participate in exercise after considering its advantages and disadvantages. The study did not find a significant relationship between self-efficacy and exercise however, increasing self-efficacy in the early stages of behaviour change was found to improve the students' engagement with exercise.

Additionally, Kuan et al. (2019) stated that over the decades many studies have demonstrated a significant relationship between the TTM and exercise behaviour. This, they

note, is supported by their study. They noted that the TTM can provided useful guidance for Malaysia's Ministry of Health and Ministry of Education in terms of developing a strategic plan in order to promote, and create awareness, of the importance of regularly engaging in exercise. These agencies can then work together to establish health policies by educating university students about the health benefits of exercise and regularly conducting exercise programmes. Moreover, sports medicine professionals, such as athletic trainers, psychologists, and physical therapists, can refer to TTM studies as sources if they need to encourage university students to participate in exercise. This the authors suggest will improve the students' ability to engage in processes of change.

A descriptive- analytical study conducted by Alidosti et al. (2017), using the TTM, was carried out amongst female high school students in Iran. This study aimed to determine how female adolescents decided to exercise by using the stages of change derived from the TTM, as a mode of analysis. Systematic cluster sampling was used to select respondents. The data were collected by a protocol developed by the researchers which included demographic characteristics, knowledge of the construct (exercise) and the stages of change (pre-contemplation, contemplation, preparation, action, and maintenance). The collected data were analysed using appropriate statistical tests. The students' knowledge was assessed by six questions (for example: How many times do you think an adolescent girl should do exercise weekly?).

Alidosti et al. (2017) reported that the mean age of participants was 13.69 years. Their study findings indicated that most of the sample were at the pre-contemplation and contemplation levels of the TTM and were not engaged in exercise. The researchers found that it was necessary to remove barriers to exercise, in order to facilitate motivation for exercise amongst this group, by educating family and communities into the benefits of exercise.

2.2.2 Limitations of the Trans Theoretical Model (TTM)

LaMorte (2019) notes that the TTM has limitations which must be considered when using it in an applied manner. The author reports that the theory does not consider the social environment and factors such as poverty and low-income. It is also noted that the stages of the TTM can be difficult to interpret in terms of where individuals are in their behaviour change. Moreover, there is no set time period, or limit, for how long individuals remain in each behaviour change stage. The TTM also infers that an individual has logical decision-making skills, which is not always the case. However, in spite of these limitations the TTM does offer a credible model for underpinning strategies that have been specifically developed out of interventions (for instance, research or public health processes).

2.3 Summary

In this section the theoretical framework was presented. How the TTM was employed in this study was noted as well as examples of how the TTM was used in other studies researching exercise behaviours. The following chapter (3) presents the literature review for the study.

CHAPTER 3

LITERATURE REVIEW

3.1 Introduction

This chapter reviews literature related to the study topic namely exercise, self-esteem, anxiety, and depression. International and South African studies were reviewed, and articles and books retrieved from various sources for instance, Google Scholar, EBSCO Host, Science Direct amongst others.

According to Linde (2014) depression is likely to negatively impact on all areas related to an individual's psychological and physical well-being. Cahuas et al. (2020) report that depression is likely to affect every person at least once in their lives thus it is important to find ways to combat it. The inability to cope with academic demands and adjusting to a new environment means that students at tertiary institutions are at risk of developing mental illnesses such as depression and anxiety disorders, which might lead to them having poor levels of self-esteem (Nel & Tshikovhele, 2018). In this regard, the present study was considered important as it addresses and discusses these issues and developed guidelines for exercise in first-year students at a previously disadvantaged tertiary institution.

3.2 The importance of exercise

According to the WHO (2021), physical activity (PA) and physical exercise (PE) have different meanings, exercise is structured and planned, and repeated for the purpose of improving health, whereas physical activity means any activity during leisure time which requires physical movement such as gardening. Additionally, regular exercise and physical activity have benefits for both the psychological and physiological aspects of personal well-being. Psychologically, exercise can help lessen the symptoms of mental disorders such as

PTSD, anxiety and depression as well as improving an individual's self-esteem and cognitive functioning (Zeng et al., 2019).

The WHO (2021) also note that engaging in regular physical exercise is a protective factor against harmful risk behaviours and diseases. Exercising regularly is known to aid in the management and prevention of non-communicable illnesses such as diabetes, stroke, some cancers, heart disease and depressive illnesses. It delivers numerous benefits such as improving motor-balance, decreasing stress, improving self-esteem, improving body image, and improving social relatedness (Laudańska-Krzemińska, 2020). These authors state that daily exercise can play a protective role in the prevention of mental illness. Transition to tertiary institutions entails a big transition for students both academically and socially, which can cause them to be stressed and anxious which can result in clinical depression (Román-Mata et al., 2020). This can be alleviated to some extent by exercise (Nel & Tshikovhele, 2018).

An article by Tahmasebi et al. (2016) reported that exercise helps prevent, and improve several health problems including high blood pressure, diabetes, and arthritis and mental illness. Exercise also helps keep depression and anxiety from returning after an individual has recovered from an illness (physical and/or psychological) as long as they keep on with the exercise regime. Furthermore, regular exercise can offset depression and anxiety by releasing feel-good endorphins which are natural brain chemicals that enhance a natural sense of well-being. It was also emphasised that individuals should try not to worry about day-to-day problems in order to get away from the cycle of negative thoughts that feed depression and anxiety.

According to Dwicahyaningtyas et al. (2021), regular exercise has many psychological and emotional benefits that help individuals gain confidence. Meeting exercise

goals or challenges, even small ones, can boost an individual's self-confidence. Getting fit can also make individuals feel better about their appearance. Additionally, exercise helps alleviate anxiety and depression by helping individuals overcome social fears which, in turn, allows them to participate more in social interactions. Furthermore, exercise and physical activity give individuals the chance to meet or socialise with others by exchanging a friendly smile or greeting while walking, running and/or attending gym sessions. Regular exercise can be seen as doing something positive in order to manage depression or anxiety. It can also be considered as a healthy coping strategy. Trying to feel better by drinking alcohol, dwelling on negative thoughts, or just hoping that feelings of depression will disappear are negative coping strategies that can lead to worsening symptoms and possible clinical depression.

Sharma et al. (2006) suggest that the importance of exercise is not adequately understood or appreciated by patients and mental health professionals alike. Aerobic exercises, including jogging, swimming, cycling, walking, and dancing are effective in reducing anxiety and depression. These improvements in mood are caused by an exercise-induced increase in blood circulation to the brain, as well as the influence on the hypothalamic-pituitary-adrenal (HPA) axis and, thus, on physiologic reactivity to stress. This physiologic influence is mediated by the communication of the HPA axis with several regions of the brain, including the limbic system, which controls motivation and mood; the amygdala, which generates fear in response to stress; and the hippocampus, which plays an important part in memory formation as well as in mood and motivation. Other hypotheses that have been proposed to explain the beneficial effects of physical activity on mental health include distraction (from problems/challenges that exist), self-efficacy, and social interaction. While structured group programmes are effective for individuals with serious mental illness, lifestyle changes that focus on the accumulation and increase of moderate-intensity activity throughout the day are the most appropriate for most individuals. Furthermore, the authors

note that adherence to physical activity interventions in psychiatric patients appears to be comparable to that in the general population.

Health Direct (2019) also indicate that exercise improves mental health by reducing anxiety, depression, and negative mood and improving self-esteem and cognitive functions. Exercise, they report, has been found to alleviate symptoms such as low self-esteem and social withdrawal. Pederson (2015) reports that individuals suffering from many illnesses, who participate in physical conditioning programmes, show improvements in weight control, and reported increased fitness levels, exercise tolerance, reduced blood pressure levels, increased energy levels and upper body and hand grip strength levels.

A study conducted by Gilani and Feizabad (2019), which assessed the effects of aerobic exercise training on mental health and self-esteem, found that increased self-esteem may be related to endocrine regulation and internal opioid systems that impact on the body after exercise. Psychological mechanisms of the beneficial effects of exercise on the quality of life include increased self-esteem, increased self-satisfaction and, increased self-confidence, improved turmoil, and physiological mechanisms including increased central norepinephrine, changes in the hypothalamic adrenocortical system, and changes in the synthesis and metabolism of serotonin and endorphin. Additionally, results of the study indicated the significant positive effect of physical exercise on the participants mental health and self-esteem. The findings indicated that engaging in regular aerobic exercise training increased the mean of self – esteem scores. This suggests that there is a positive relationship between exercise and increasing self-esteem. It was also reported that interventions such as carrying out mild to moderate physical exercise for four sessions a week for a period of nine months, had positive effects on the self-esteem of depressed patients. In this regard, individuals with higher self-esteem evaluated themselves in a more positive manner and had a more positive attitude about themselves.

3.3 Tertiary education students and physical exercise

A cross-sectional survey study was conducted amongst university students from fifteen universities in the Kingdom of Saudi Arabia by Alkhateeb et.al. (2019). This research was aimed at determining the pattern of students' physical exercise practices before and during college attendance. The results indicated that there is a significant decrease in participating in regular exercise during college years in comparison to the years prior to attending college. To address this decrease in physical exercise it was recommended that it was important to organise and promote awareness campaigns about the benefits of physical exercise, as well as providing suitable sports facilities and infrastructure. The authors asserted that physical exercise is important for improving lifelong health and reducing morbidity risks.

Another study aimed at investigating the level of exercise amongst university students was undertaken by Murphy et al. (2019). These researchers used the self-administrated International Physical Activity Questionnaire (IPAQ) in order to investigate how physically active, the sample were. Questionnaires were interpreted as: 1) vigorous activity; 2) moderate activity; 3) walking, and 4) sitting in last seven days. A total of 334 students participated in this study. Anthropometrics measurements were reported such as height, weight, and body mass index (BMI). Most of students had a normal body weight and BMI. Results found that both genders exercised however, male students were more physically active and fit than female students.

Boozer (2017) conducted a study that examined the relationship between physical activity levels in college students and health related quality of life scores. The results of the research indicated that the two variables (physical activity and health related quality of life) were significantly related with a positive correlation value. The authors recommended that more research should be conducted in this area, with a larger sample.

Homonoff et al. (2020) conducted an experimental study amongst first year students at a university in Switzerland in order to identify the effects of exercise on educational outcomes. Several potential mechanisms were identified through which increased exercise on-campus could influence educational outcomes. Firstly, characteristics of activities including frequency, location, timing, and type were investigated; secondly, students' use of time was explored and thirdly, several self-report measures of health and emotional well-being were used. Benefits of exercise on these dimensions have been extensively documented. They include gains in productivity and, as a result, improved educational outcomes. The results of this study suggested that there was a substantial positive impact on-campus related exercise on educational outcomes. The survey data also provided evidence that students, who engaged in physical exercise and activity, spent more time in class. Together, these findings indicated that integrating studying and exercising during the day enhances the productivity of students and is likely to improve their academic performance.

Research by Edwards (2002) suggests that exercise makes an individual physically and, to an extent, psychologically fit. Additionally, it was noted that physical exercise should be teamed up with relaxation techniques. Moreover, individuals should learn relaxation techniques to ensure that they are able to relax after exercise regimes and for instance, before taking tests or exams. Relaxation techniques are addressed in the next sub-heading.

3.3.1 Relaxation techniques for students

Relaxation techniques such as relaxed breathing, progressive relaxation and meditation are very effective particularly when used with physical exercise regimes (Edwards, 2002; Tshikhovhele, 2015). They influence the parasympathetic branch of the nervous system to have the exact opposite reaction to the sympathetic branch, where the initial *fight or flight* reactions are stimulated by the stress response (Holden, 1992). There are

various relaxation techniques, which can be used together or separately (See appendix 2 for more information).

The following is adapted from Edwards (2002).

1. An individual must learn to know his or her state of tension/relaxation by tensing his or her entire body while counting to ten, then alternatively relaxing while counting to ten. An individual may also practice this with different muscle groups from head to toe. It should also be practiced until deep instant relaxation is obtained purely by saying *relax* and counting to ten.

2. Secondly, belly breaths by focusing on his or her stomach, not chest, moving slowly in and out.

3. Thirdly the individual should relax, and belly breathe.

4. Fourth, an individual should relax and visualize a calm scene of the sea or a meadow.

5. Fifth an individual should relax and consciously ask him or herself what she can feel, hear, see, smell, taste, and touch.

6. Lastly, one must practice dynamic relaxation while moving by adjusting his or her level of tension.

Learning relaxation involves cultivating a muscle sense in order to develop the muscle memory further, individuals are taught to isolate and contract specific muscle groups one at a time (Sadock & Sadock, 2007).

According to Gerans and Waluyo (2019), progressive muscle relaxation (PMR) is a relaxation technique that requires an individual to focus on flexing and holding a certain set of muscles and then slowly relaxing those same muscles. As the individual flexes and releases those muscles from head to toe they feel a deep sense of relaxation. Progressive muscle relaxation (PMR) is an adapted version of Jacobson's (1934) relaxation technique (See appendix 2) developed in the 1930s.

According to Tshikhovhele (2015), progressive muscle relaxation (PMR) is currently used in clinical and non-clinical settings to reduce the effects of anxiety and sleeplessness brought about by stress. The long-term goal of this relaxation technique is to be able to identify when body muscles are suffering the effects of stress. The technique is used to help relax the individual and the individual's muscles. The premise is that an individual cannot be relaxed and stressed at the same time (Gerans & Waluyo, 2019).

Edwards (2002) and Tshikhovhele (2015) reported that relaxation techniques can be used at any time and are helpful for people who engage in physical exercise as they are not just exercising their bodies, they are exercising their cognitive skills.

3.4 University students and mental health/psychological issues

Mboya et al. (2020) report that students attending tertiary institutions have high amounts of psychological stress which may lead to them using and abusing both illegal and legal substances for instance, tobacco, alcohol, marijuana, and heroin. These substances are all associated with a higher risk of depression, anxiety disorders as well as engaging in risky sexual behaviour. These behaviours increase mental distress amongst students which is also heightened by other factors such as academic work and examinations, a family history of mental illness, lack of close friends, conflict with peers, financial problems, and a lack of interest in their chosen field of study.

A study conducted by Park et al. (2020) investigated university students' lived experiences of maintaining mental well-being during major life events and challenges associated with this transitional period, before entering the workplace. Their first aim was to understand how university students' psychological well-being was preserved during this period and how they merged from adolescence through to adulthood. Secondly, they sought to provide guidelines on how academic and social systems support a student's psychological well-being. Semi structured interviews were conducted with 19 students from a tertiary institution in America. The findings of this study identified three key areas namely: the need to continually rebuild relationships with support givers because of frequent changes in the students' lives; the need to seek help when serious life-challenges arose and lastly the need to discuss any challenges with an objective person. This research also recognised the three major factors related to maintaining mental well-being which are disclosure (to tell someone), audience (to discuss with the 'right' person) and time (to have the time to talk about challenges).

Bert et al. (2020) report that mental health issues are very common among students attending tertiary institutions. They conducted a cross sectional survey study which assessed factors of perceived stress, suicidal ideation, and depressive symptoms in a sample of Italian students. The scales used were, The Perceived Stress Scale (PSS) and the BDI-11. Results indicated that more female students as compared to male students were likely to see a psychiatrist or psychologist. This was positively related to their levels of perceived stress. However, all students reported high levels of mental health issues linked to both their academic and social life. The study recommended that tertiary institutions provide efficient interventions in this regard.

Walkiewicz and Guziak (2021) reported that medical students in Poland suffer from serious levels of stress which leads to mental health problems, including suicidal ideation.

Furthermore, medical students do not seek help because of environmental ostracism and stigmatisation. The results of this research indicated that due to insufficient central regulations from for instance, government and higher education, support is offered individually by medical schools and is not mandatory or regulated. Therapeutic interventions also focused on short-term or brief therapy. Students were referred to other health providers if they needed more extensive therapeutic interventions. The researchers found that although academic portals, giving information to students were easily accessible, they did not give enough information or assistance for students requiring mental health support. Moreover, information about mental health support for students who asked for help was not transferred by user-friendly or secure communication channels. It was recommended that a future model of psychological support could be a centre organised as a transfer point between a university problem-solving facility and external health providers. This would ensure rapid support and would eliminate potential complications and more serious mental-health problems

According to Kivlighan et al. (2020), in a study conducted at various American tertiary institutions students, fared better academically and socially post-psychological counselling. It was noted that student retention remains a serious problem for students in colleges and post-secondary school institutions in America which, in part, is related to students not being ready (psychologically) to attend them. The authors indicated that psychological counselling centres in tertiary institutions should be well located and not in a visible position so that students could access help without being observed (to prevent stigmatisation). This, it was postulated, would improve student retention by addressing their psychosocial and psychological, as well as academic challenges. This study had 1231 respondents who consulted 49 therapists at various institutional counselling centres. Findings noted that students who were clinically distressed, and who went to psychological counselling, had positive results in their academic grade point average (GPA) and were better

adapted psychosocially, post-counselling. In conclusion it was suggested that psychological counselling was beneficial to the academic and psychosocial success of American tertiary education students.

Pedrelli et al. (2015) suggest that the years spent in tertiary education signify a period of elevated vulnerability for various mental health disorders. They report that during this developmental period common psychiatric conditions often come to the fore. Rises in rates of suicidality, depression and anxiety have been observed in many American tertiary institutions. As these students live in an environment which is new to them there is a need to identify major stressors when dealing with their mental health challenges. In conclusion, the authors noted that by becoming familiar with the unique challenges and problems that tertiary education students encounter psychologists, and other allied health professionals will be better able to help them.

According to Auerbach et al. (2018), tertiary education institutions worldwide are struggling with the rising number of mental health problems found amongst students. A study that included 19 tertiary institutions from 8 countries estimated the prevalence and socio-demographic links of shared lifetime psychological disorders and/or 12-month disorders as over 60%. These countries included the United States of America (USA), Northern Ireland, Australia, South Africa (SA), Belgium, Mexico, Spain, and Germany. Internet-based self-reporting surveys were administered to first entering students and screened for the most common psychological disorders namely, MDD, Manic/hypomanic disorders, anxiety disorders, panic disorders, alcohol use disorders and substance use disorders. The final sample was 13,984 full-time students. Thirty five percent (35%) of this sample screened positive for at least one of the common lifetime disorders measured and 31% for at least one 12-month disorder. Additionally, non-heterosexual females with no religious orientation were more likely to have one of these conditions although the correlation was

weak. The authors recommended the need to target students who are more likely to suffer mental health issues and offer appropriate psychological services on tertiary education campuses.

3.5 Physical exercise and self-efficacy

Although one can have high self-efficacy (individual confidence to do things) without high self-esteem (overall evaluation of individual self-worth) there is a significant relationship between self-efficacy and self-esteem (Brammante, 2015). For this reason, it is discussed in this section as for instance, in terms of this research an individual may believe they can run 5 kilometres (self-efficacy) having not exercised for many years. They find this is incorrect and are unable to run more than 500 metres which impacts negatively on their self-esteem.

The construct of self-efficacy was introduced by Albert Bandura (1986) who was a psychologist based at Stanford University in the USA. Pekmezi et.al. (2020) state that self-efficacy refers to an individual's confidence in his or her abilities to successfully perform a particular behaviour. For example, if individuals are sure they can walk a kilometre without any difficulty, then their self-efficacy for that particular behaviour is high. On the other hand, if individuals are quite certain that they would become exhausted and need to stop after only a few steps, then their self-efficacy for walking the kilometre is low. Self-efficacy theory suggests that, if individuals believe that they can perform a behaviour successfully, they will be more likely to engage in that behaviour. This concept has important implications for health behaviour change and has been applied to numerous health domains, such as nutrition, weight loss, alcohol use, smoking, sun protection, and physical activity. Research has shown that self-efficacy beliefs impact the adoption of new health behaviours, their generalisation to varying circumstances, and their maintenance over time.

Hebdon et al. (2021) also report that self-efficacy influences how health behaviours can be generalised to varying circumstances depending on the activity, situation, and even time of the year. For example, individuals may feel confident about their ability to engage in some forms of physical exercise such as walking, but not aerobics. Self-efficacy beliefs play a role in maintenance of health behaviours over time. In their study the authors indicated that self-efficacy predicted the maintenance of physical activity among adults 5 years after completing a 6-month walking programme. This is noted as an important issue because of the many health benefits that are derived from maintaining an active lifestyle.

According to Lazarević et al. (2017), holistic self-esteem concerns a total assessment of the self, while self-efficacy is a more specific construct related to an individual's psychological characteristics. Self-efficacy is the central component of Bandura's socio-cognitive theory (Bandura, 1997; Rikhusshuba & Huda, 2020) and can be described as an individual's beliefs about their skills and abilities which allow for the successful completion of a task, in specific circumstances. Physical self-efficacy indicates an individual's competencies to perform a specific physical activity. Physical self-efficacy is also considered as a determinant of adherence to exercise and as an outcome of physical exercise. Moreover, there is link between having a good body image and high levels of psychological or cognitive self-efficacy.

Considering the emotional and physical consequences of inactivity, an investigation by Mburu-Matiba (2015) found that individuals who exercise and eat well have a better quality of life. These individuals were also found to be in less danger of becoming ill. In this regard, commitment to physical activity was perceived as underpinning high-levels of physical and psychological wellness, social prosperity, and cognitive and academic performance. Additionally, it was found that regular physical activity is connected to a decrease in cardiovascular illness, type 2 diabetes, depression, weight, higher cognitive

functioning, and positive life-satisfaction. It was demonstrated that individuals who are physically active, and take part in group activities, are less inclined to participate in unhealthy behaviours for example, abusing substances and dangerous sexual activities. Alfonso (2019) also found that individuals who were inactive led less healthy lifestyles and had poor self-esteem.

3.6 Physical exercise and self-esteem

Exercise is one of the most under-endorsed treatments for individuals with mild to moderate depression. Exercise lessens symptoms related to anxiety, depression, and PTSD as well as improving cognitive functions and self-esteem. These effects are neuro-psychochemical in nature since exercise encourages the emission of neurotransmitters such as adrenaline, endogenous opiates, and serotonin. (Nel & Tshikovhele, 2018). Self-esteem is recognised as one of the predictive factors that has a positive effect on anxiety and academic performance. The growth of self-esteem is measured by a dynamic process namely an individual's ability to learn throughout their life, incorporating concepts of adaptability, resilience, and belief in self (Sari et al., 2018).

Mandolesi et al. (2018) suggest that high self-esteem is linked to individual's having an optimistic emotional state. Moreover, physical exercise is reflected as significant for bodily, as well as psychological health. High self-esteem is also associated with better psychological and physiological welfare. Physical exercise has an important relationship with self-esteem in individuals of all ages in that regular exercise and activity leads to improved mental well-being. The authors state that physical activity and exercise have positive effects on depressive symptomology.

Pérez-Fuentes et al. (2019) report that research into self-esteem has stimulated much interest due to its close association with physical and mental well-being, social change, and

quality of life. High levels of self-esteem are also related to optimal academic progress and positive work performance, while low levels of self-esteem have been linked to depressive symptomology such as, anxiety, suicidal ideation, eating, anorexia, bulimia, and violent behaviour. In support of this Azmitia et al. (2018) state that self-esteem is a predictor of good university academic performance. They also report that high levels of self-esteem are associated with achieving set goals in life. High self-esteem was also found to be positively correlated to academic self-efficiency amongst students It is also a factor in individual resilience and enhanced efforts in terms of completing academic work.

In a study by to Lazarević et al. (2017) it was shown that self-esteem is positively related to physical activity in sport and other recreational endeavours. Exercise is highlighted as very important for human well-being. Physical exercise influences positive psychological characteristics, such as self-esteem. In this regard the authors report that high levels of self – esteem can be promoted by exercise. Exercise also gives individuals a positive body image and elevates the concentration of neurotransmitters in the brain by stimulating the sympathetic nervous system. Research by Hamidah et al. (2019) underpins this by suggesting that exercise enhances self-esteem and plays an important role in increasing the work capacity of individuals.

Malm et al. (2019) conducted a review which looked at public health in Sweden. In their review they looked at literature examining the impact of exercise on the self-esteem on students. They found that exercise or any physical activity has positive health benefits in terms of psychosocial and personal development. They also note that there can be negatives such as injuries and worrying about the risk of failure (in specific sporting codes). The review summarised research in this field it noted that there are growing problems with obesity in Sweden and other illnesses related to sedentary lifestyles such as diabetes-11. It was also noted that physical exercise and activity help prevent and alleviate the symptoms of mental

disorders such as depression and/or various types of anxiety. The authors recommended that individuals should be active and participate in exercise and sports even if it is to a moderate degree as this improves general well-being and self-esteem.

A systematic review by Kayani et al. (2018) looked at the relationship between exercise, depression, self-esteem, and academic performance in students. It also examined whether the relationship between exercise and academic performance is mediated by depression and self-esteem. The three main findings of this review were that self-esteem, exercise and academic performance are positively related and that depression, exercise and academic performance were also positively associated. The authors concluded that depression and self-esteem play an important mediating role in the relationship between academic performance and exercise. Furthermore, they found a strong relationship between exercise and high levels of cognitive function. In this regard, advanced cognitive activity and understanding relates to positive psychological concepts like self-esteem. The direct effects of exercise were also reported as connected to positive self-esteem and noted as a significant factor in improving it. This review emphasised the finding that students who exercised had higher levels of self-esteem than those who did not which reduced levels of depression and had a positive impact on academic performance. In conclusion, it was suggested that lack of exercise in students is a public health concern as exercise is a tool for enhancing students' cognitive activity, as well as their psychological and physiological well-being.

3.6.1 Gender, self-esteem, and physical exercise

Links between gender and perceived self-esteem are undisputed but most research suggests that generally males have better self-confidence and esteem (Brammer, 2018; Carek et al., 2011). To explain gender differences in self-esteem, age should be considered. Carek et al. (2011) conducted a large cross-sectional study on a sample of respondents (aged from 9 to 90 years old) from more than 100 countries. The findings demonstrated stable trends in self-

esteem in males and females during a lifetime: self-esteem is highest in childhood, decreases in adolescence, slowly increases until adulthood and reaches a plateau at around 30 years of age. It decreases again in the later stages of life. Brammer (2018) reports that physical activity plays a role in stabilising and lessening feelings of anxiety while promoting positive overall well-being and mental health and self-esteem, irrespective of the persons' gender or age. Exercise has been indicated as a strong measure for use in the treatment of anxiety and depression. Anxiety has been reduced significantly by a 20-minute exercise regime three times a week. Self-reported fears and anxiety which include respiratory and cardiovascular symptomology decreased following a prescribed exercise programme. This is supported by Cox et al. (2004) who report a significant decrease in state anxiety 90 minutes after 20 minutes of aerobic exercise at 80% of maximal oxygen uptake. This is also linked to individual's having better self-esteem (Brammer, 2018).

Rostami et al. (2016) conducted a study designed to investigate the effect of physical activity and gender on students' self-esteem at Shiraz University in Iran. A random-comparative research design was employed to conduct this research. The population included all undergraduate students registered at the institution. Participants were selected through random cluster sampling and 332 students filled out the Coopersmith Self-Esteem Inventory (CSEI). When all the questionnaires were perused, and those that were filled out incorrectly removed, the final sample was 218. A two-way analysis of variance (ANOVA) was used to analyse results ($p \leq 0.05$). The results indicated that gender and physical activity were both significant in terms of self-esteem. Active students had higher self-esteem as compared to inactive ones ($p = 0.02$). The self-esteem scores of female students were higher than male students ($p = 0.05$). The results of this research indicate that participation in physical exercise improved the self-esteem of the sample. Furthermore, female students enjoyed higher self-esteem as compared to male students.

Gilani and Dashipour (2017) conducted a study investigating the effects of eight weeks of aerobic exercise on the self-esteem of medical students at Zahedan University of Medical Sciences in Iran. This study used the 58-item CSEI to measure the self-esteem of 84 male students who participated in the research. The results showed that in the experimental group, the variation in the mean self-esteem score was 32.36 (before) and 42.89 after the intervention. In the control group there was no change in mean scores as they did not receive the exercise intervention. It was also revealed that aerobic exercise increased self-esteem in the experimental group (exercise) group. The researchers concluded that an improvement in educational, family, social, and general self-esteem scores was only seen in the experimental group.

3.7 Physical exercise and anxiety

According to Nyberg et al. (2019), anxiety disorders are frequently associated with a diminished quality of life, decreased physical and mental health, and increased financial challenges. This spectrum of disorders is found in all cultures particularly in students registered at tertiary institutions. Test anxiety is reported as a major problem faced by students and has been shown to have a negative association with academic performance in both genders (Duraku & Hoxha, 2018). This is supported by Numan and Hasan (2017) who report that poor academic outcomes are associated with high student test and exam anxiety. See table 1 (p.35) for diagnostic criteria for anxiety disorders from the DSM-5 (APA, 2013).

3.7.1 DSM-5 and anxiety in students

Anxiety has been found in students due to social, academic and relationship anxiety which, if left untreated, can sometimes result in a full-blown anxiety disorder. The DSM-V defines social anxiety disorder (SAD) as an intense fear or anxiety about one or more social situations where an individual is exposed to scrutiny by others for example, social interactions (for instance, having a conversation, meeting new people), being observed (for

instance, eating or drinking), and performing in front of others (for instance giving a speech). Social anxiety disorder (SAD) also called social phobia is characterised by an individual having persistent and unreasonable fear of being evaluated negatively by other persons when in a social situation, particularly with unfamiliar people (Reta et al., 2020).

Kibru et al. (2020) report that students with a SAD may become functionally disabled in different areas of their life, such as poor educational achievement, unstable part-time employment, absenteeism from work and decreased productivity which leads them to being dependent on family, community, and the state. Medical students with social phobia have shown low performance in clinical examinations and have reported depressive symptoms. Furthermore, students with social phobia are more likely to abuse substances which can result in a permanent disruption to their lives.

Many medical professionals do not think about prescribing lifestyle interventions for depression and anxiety. They prescribe pharmacological interventions alone for mild to moderate depression and do not consider exercise interventions which have been shown to alleviate both anxiety and depression (Rippe, 2018). The important role of exercise in the treatment of these disorders is based on strong evidence that regular exercise is important for brain health and cognition, as well as a reduction in anxiety and depression and amelioration of stress (Hu et al., 2020).

To illustrate diagnostic criteria for anxiety disorder, a table of symptomology, adapted from the DSM-5, has been provided (APA, 2013).

Anxiety Disorder adapted from the DSM- 5 (APA, 2013)

A. Excessive anxiety and worry (apprehensive expectation), occurring more days than not for at least 6 months, about a number of events or activities (such as work or school performance).

B. The individual finds it difficult to control the worry.

C. The anxiety and worry are associated with three (or more) of the following six symptoms (with at least some symptoms having been present for more days than not for the past 6 months): Note: Only one item required in children.

1. Restlessness, feeling keyed up or on edge.

2. Being easily fatigued.

3. Difficulty concentrating or mind going blank.

4. Irritability.

5. Muscle tension.

6. Sleep disturbance (difficulty falling or staying asleep, or unsatisfying sleep).

D. The anxiety, worry, or physical symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

E. The disturbance is not attributable to the physiological effects of a substance (e.g., a drug of abuse, a medication) or another medical condition (e.g., hyperthyroidism).

F. The disturbance is not better explained by another medical disorder (e.g., anxiety or worry about having panic attacks in panic disorder, negative evaluation in social anxiety disorder

[social phobia], contamination or other obsessions in obsessive-compulsive disorder, separation from attachment figures in separation anxiety disorder, reminders of traumatic events in posttraumatic stress disorder, gaining weight in anorexia nervosa, physical complaints in somatic symptom disorder, perceived appearance flaws in body dysmorphic disorder, having a serious illness in illness anxiety disorder, or the content of delusional beliefs in schizophrenia or delusional disorder).”

Table 1: DSM-5: Anxiety disorder diagnostic criteria (APA, 2013)

Jadhav (2017) conducted a study which looked at the influence of exercise on anxiety in college students. Sixty non-exercising male students aged 19 to 36 years were randomly divided into two groups. Thirty male students engaged in a 6-week physical fitness schedule of three one-hour sessions a week. The other 30 students did not participate in this schedule. The effect of levels of anxiety between the control and experimental group was tested by an independent t-test. The results indicated that there was significant difference in ($p=0.01$) levels of exercise on anxiety amongst male students with those participating in the exercise regime showing less anxiety. A study by Anderson and Shivakumar (2013) which looked at the effect of physical activity on anxiety supported these results. The results of this research indicated that regular exercise was beneficial to both mental and physical health. Additionally, a scheduled regime of exercise helps give these benefits across all age groups and racial and/or cultural groups.

Adegoju and Abon (2021) report that mental health issues are quite severe amongst students attending tertiary institutions. They conducted a study at a Nigerian tertiary institution investigating the effect of exercise participation on designated indices (depression and anxiety) of mental health amongst a sample of student athletes and non-athletes. The outcomes of this research indicated a strong discrepancy between exercising and non-

exercising students attending the university in terms of depression and anxiety. Although anxiety and depression were detected amongst the experimental and the control group it was found that students who engaged in physical exercise were less likely to be depressed and anxious. It was also concluded that for both genders engaging in exercise contributed to positive mental health outcomes.

A cross sectional survey was conducted by Lun et al. (2018) which looked at the occurrence of depression and anxiety amongst undergraduate university students in Hong Kong. A total of 1200 undergraduate students from eight institutions took part in the study. Self-report questionnaires were used to collect data, including the 9-item Patient Health Questionnaire (PHQ) for assessing depressive symptoms and the 7-item Generalised Anxiety Disorder Scale (GADS) for assessing anxiety symptoms, as well as a socio-demographic questionnaire. Respondents reported mild to severe depressive symptomology which were linked to mild to severe anxiety symptoms. Numerous lifestyle and psychosocial variables, including consistent exercise, self-confidence, happy with academic progresses, and positivity towards the future (in terms of academics) were inversely correlated with mild to severe depressive symptoms. In concluding the authors reported that the majority of respondents self-reported some symptoms of depression and anxiety. Nine-percent (9%) of respondents indicated moderate to severe depressive symptoms and 5.8% reported severe anxiety symptomology. Respondents who reported that they exercised regularly showed higher levels of self-confidence and overall life-satisfaction in regard to social and academic progress. They also reported less depressive and anxiety symptomology.

3.8 Physical exercise and depression

Kandola et al. (2019) reviewed articles discussing physical exercise, activity, and depression. They determined that exercise could treat and prevent depressive symptoms, but its antidepressant mechanisms have yet to be properly established. In their review they comprehensively assessed key biological and psychosocial mechanisms through which physical exercise exerts antidepressant effects. Depression in the study uses DSM-5 (APA, 2013) criteria for instance, feelings of hopelessness, difficulty concentrating, lack of energy, agitation, restlessness, feelings of worthlessness or pessimism, and suicidal ideation. However, they report that there are few studies on the relation between depression and physical exercise in university students. Furthermore, most studies in this area have been conducted on children and adolescents (pre-tertiary education) from different age groups. These studies have found links between increased physical exercise and improvement in academic achievements. The authors also noted that their review of the literature revealed that physical activity and exercise have constructive effects on depression. Moreover, the authors note that recent studies have shown that exercise has a positive influence on mood for those who are clinically depressed for instance, those who have MDD. Table 2 presents the diagnostic criteria for MDD adapted from the DSM-5 (APA, 2013).

Major Depressive Disorder (MDD) diagnostic criteria adapted from the DSM- 5
(APA, 2013)

The Major Depressive Disorder diagnostic criteria of the DSM - 5 are listed below. These symptoms are severe but can be mis-diagnosed in athletes as too much stress before big events (Edwards, 2006).

A. Five (or more) of the following symptoms have been present during the same two-week period and represent a change from previous functioning, at least one of the symptoms is either depressed mood or loss of interest or pleasure.

- 1) depressed mood most of the day, nearly every day, as indicated by either
subjective report (for example, feels sad or empty) or observations made by others
(For example, appears tearful)
- 2) Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly everyday
- 3) Significant weight loss when not dieting or weight gain
- 4) Insomnia or hypersomnia nearly everyday
- 5) Psychomotor agitation or retardation nearly everyday
- 6) Fatigue or loss of energy nearly everyday
- 7) Feelings of worthlessness or excessive or inappropriate guilt nearly everyday
- 8) Diminished ability to think or concentrate, or indecisiveness, nearly everyday

9) Recurrent thoughts of death (not fear of dying), recurrent suicidal ideation without specific plan, or a suicidal attempt or a specific plan for committing suicide.

B. The symptoms cause clinically significant distress or impairment in social, occupational, or other important areas of functioning.

C. The episode is not attributed to the physiological effects of a substance or to another medical condition.

D. The occurrence of the major depressive episode is not better explained by Schizoaffective Disorder, Schizophrenia, Schizophreniform Disorder, Delusional Disorder, or other specified and unspecified schizophrenia spectrum and psychotic disorders.

E. There has never been a manic episode or a hypomanic episode.

Table 2: DSM -5 Diagnostic criteria for Major Depressive Disorder: MDD (APA, 2013)

In a study conducted by Linde (2014), which is supported by similar findings in later research by Cahuas et al. (2020), depression was reported as a mental disorder that affects 340 million people globally. It was also reported that in the next decade it will become the most life-threatening cause of incapacity worldwide (Serretti, & Porcelli, 2018). According to Krogh et al. (2011), all types of depression both severe and mild improve to some degree if an individual engages in physical exercise. It was also noted that using ‘green’ prescriptions, like recommending exercise is cheaper and less invasive, with fewer or no serious side effects than pharmacological interventions. A study which supported these results revealed that non-

professional exercise routines were as effective as work-out programmes designed by a professional trainer in lessening depression (Pickett et al., 2017).

Edwards (2006) and Nel and Tshikovhele (2018) researched how exercise influences depression in two South African studies. These authors found that depression affected all areas of an individual's life from work through to peer and family relationships. Additionally, Edwards (2006) noted that those who reported depression had other physical health issues such as diabetes. Co-morbid conditions were noted as problematic in terms of depression which underpins research by Van Biljon et al. (2018) and Al-Fazari et al. (2021) who report that depression often occurs in individuals with health problems for instance, cardiovascular disease (CVD) and diabetes.

Paolucci et al. (2018) report that exercise may help to mitigate symptoms of depression however, little is known about the influence of exercise intensity on depressed mood. A study was conducted with a sample of university students who were allocated 6 weeks of high-intensity interval training, moderate continuous training, or no exercise respectively, throughout one semester. Changes in depression, anxiety, and perceived stress along with pro-inflammatory cytokines tumour necrosis factor alpha, interleukin-6, interleukin-1 beta, and C-reactive protein were measured. The results of this study indicated that depression increased for non-exercisers, signifying how fast psychological health can deteriorate for students during a semester. It was also found that moderate continuous training, reduced depression, and pro-inflammatory cytokine levels. Additionally, though high-intensity interval training reduced depressive symptoms, it also elevated increased perceived stress, tumour necrosis factor alpha and interleukin-6 relative moderate continuous training. The researchers postulated that this may be because of higher levels of physical stress induced by more active exercise procedures. The conclusion of this study

recommended that moderate-intensity exercise may be the best intensity of exercise for the elevation of psychological health by reducing tumour necrosis factor alpha.

Observational research was conducted Pilipović-Spasojević et al. (2020) with the aim of determining the correlation between physical activity, stress, anxiety, and depression in female students. It involved a sample of 408 healthy female students aged 19-22 years. Surveys including a socio-demographic questionnaire, the DASS-21 for mental health assessment and the International Physical Activity Questionnaire (IPAQ) were used to collect data. Calculation of weight and BMI were performed using an anthropometric test. This research found that high intensities of exercise had no influence on stress but had an influence on depression and anxiety. It was found that exercise can influence the emotive state of young female students in a positive manner.

Zhang et al. (2020) conducted a study with the aim of evaluating the levels of self-awareness, exercise, sleep quality, depression, and life satisfaction of university students during the Covid-19 pandemic. A total of 200 university students participated which was broken down into 133 females and 67 males. Data was collected using the International Physical Activity Questionnaire, the Pittsburgh Sleep Quality Index (PSQI), the Becks Depression Inventory (BDI-11) and the Life Satisfaction Questionnaire (LSQ). The results of this study indicated that during the pandemic exercise routines were reduced. It was found that students who devoted more time to exercise during the acute phase of the pandemic preferred doing moderate - and high - intensity exercise. A regular exercise programme was thus seen as crucial for protecting physical and mental health. Furthermore, the authors reported that exercise during the pandemic increased life-satisfaction, sleep quality and self-awareness and helped reduced depressive symptomology.

3.9 Global studies relating students, exercise, and psychological health

Espinoza et al. (2020) report that globally the predominance of mental illness among first-year university students has been detailed as high. They state that not being physically active has been shown to be the 4th leading cause of mortality worldwide. Furthermore, physical inactivity is regarded as one of the major public health concerns of the 21st century. Moreover, the physically inactive are susceptible to many illnesses such as CVD and other serious conditions such as, hypertension, obesity, diabetes mellitus and high cholesterol. The authors also note that most studies on physical activity and exercise among students in tertiary institutions have been largely conducted in developed and high-income countries. They suggest that more research on this topic should be undertaken in developing countries.

A study conducted by Ahmed et al. (2020) looked at the effect of physical exercise on the stress of dental students. A cross-sectional web-based questionnaire was conducted amongst undergraduate dental students at Riyadh Elm University in Saudi Arabia. The focus of the research was to contrast the stress levels of students who exercised, and those who did not. The results of this study indicated that more than half of the respondents reported they did not exercise. Most of the respondents reported that they would like to exercise. The most stress-provoking field was 'workload' with a score of 2.69 ± 1.05 followed by 'self-efficacy beliefs' which scored 2.57 ± 0.76 and 'faculty and administration'. Students who did not exercise recorded higher stress levels than those who did, in all domains. The conclusion of the study indicated that most of the students did not know about the benefits of exercise in reducing stress.

Mboya et al. (2020) undertook research amongst undergraduate students at Kilimanjaro Christian Medical University College, Tanzania. Simple random sampling was used in this research with a final sample of 402. Psychological distress was measured by means of a self-report survey. Data was analysed using descriptive statistics and

multivariable logistic regression. The results indicated that, 14% of the sample were positive for mental distress. Other findings revealed that living off-campus with social support and some degree of physical activity decreased the chances of psychological distress. Students with a family history of psychological distress and those with poor grades had a higher probability of psychological distress.

A study was conducted by Tyson et al. (2010) which investigated the association between exercise and mental health in an undergraduate university population based in the UK. One hundred students completed questionnaires measuring their levels of anxiety and depression. The results of this study indicated a significant difference between the low, medium, and high exercise groups on the mental health scales, indicating better mental health for those who engaged in more exercise. The results also highlighted that engagement in exercise can be an important contributory factor in the mental health of undergraduate students.

Another study conducted by Kim et al. (2021) looked at the effect of Korean college students' physical activity levels on depression and personal relationships. Participants were 525 college students from five Korean cities. The IPAQ, BDI-11 and the Leary Interpersonal Check List were used to measure self-reported physical activity volume, depression, and interpersonal relationships, respectively. Data were analysed using descriptive statistics, one-way analysis of variance (ANOVA), and a Pearson Product Moment analysis. The results revealed significant differences in terms of emotional, cognitive, and synchronic symptoms of depression across activity levels in groups. In interpersonal relationships, evaluated according to different levels of physical activity, for sociometric disposition, there were differences between groups in the sympathetic-acceptable and sociable-friendliness factors and for expressive disposition there were differences in the competitive-aggressive and rebellious-distrustful factors. There were statistical correlations between the physical activity

volume and depression and physical activity and interpersonal relationships.

Recommendations were that subsequent research should examine Korean college students' physical activities and causal relationships using different psychological variables. In conclusion the authors stated that Korean college students experience various social, environmental, and psychological changes in their transition to adulthood. This can cause depression and affect interpersonal relationships. Furthermore, they stated that it is important to collect basic data for managing university students' depression and interpersonal relationships through physical activities, as exercise is known to positively affect not only physical but also psychological health.

3.10 Sub-Saharan studies on students, exercise, and psychological health

Edwards (2006) focused on how depression affects individuals in a South African study and found that it impacted on their day-to-day life. Symptoms of depression worsened if individuals had other physical disorders such as heart disease or diabetes. Another South African study addressed the influence of exercise on depression (Tshikovhele & Nel, 2018). These authors stipulated that the best intervention for low levels of psychological well-being and depression was exercise. The investigation was conducted on students at a rural university and overall, it found that exercise had a positive impact on rates of depression in students.

Aronsson and Ågren (2020) state that mental illnesses, such as anxiety and depression, are public health problems. Furthermore, an individual's physical fitness is associated with their mental health. Moreover, most studies on this have been conducted in the developed world and few have been undertaken in sub-Saharan Africa. It has also been found that countries in this region have few, if any, guidelines regarding physical activity and activity although the importance of exercise is well known. These authors conducted a study investigating to what extent physical fitness, grip strength (GS), and a 20-meter shuttle run

test (20MSRT), BMI and waist circumference (WC) correlate to self-reported anxiety in South African students at the University of Western Cape (UWC). The results showed a significant positive correlation between BMI and levels of anxiety in women, but not in men. The correlation of anxiety related to WC, GS and 20MSRT showed no significance for the whole sample or gender, respectively.

Another South African study conducted by Van der Walt et al. (2020) explored the relationships that exist between first-year students' sense of purpose and meaning in life, mental health, and academic performance. Empirical data was obtained from 269 respondents (18-22 years = 60.97%; female = 55.80%) who completed the Purpose in Life Test and the Mental Health Screening Questionnaire (MHSQ) that assessed their sense of purpose and meaning in life and mental health. The results suggested that students were still exploring the nature of their sense of purpose and meaning in life ($M = 109.21$; $SD = 21.05$) and that small, but significant relationships existed between their sense of purpose and meaning in life and mental health. These findings suggested that those involved with the mental well-being and overall health of students should consider developing interventions which might for instance, include some form of physical activity or exercise.

Nel and Tshikovhele (2018) conducted research on a non-proportional quota sample of 30 students who exercised regularly and 30 students who did not exercise regularly. They focused on the impact physical activity had on the students' stated levels of psychological well-being and depression. Data were collected using two standardised questionnaires. Results revealed that positive psychological well-being was higher in students who exercised frequently, while those who did take part in physical exercise at all had a more negative wellness profile. There were no significant differences between non-regular exercisers and regular exercisers in terms of depression which is not consistent with other research findings. However, this may be because the sample was purposive and small. Females, in the study,

who took part in exercise showed more positive psychological well-being on the scale, as compared to males ($p=0.001$), which was a significant result.

Another South African study was conducted by Muzindutsi et al. (2014) examined the perception of university undergraduate students regarding the benefits and barriers to physical exercise. A self-administered survey questionnaire was used to collect data from 480 students at North-West University, Vaal campus in Gauteng province, South Africa. Data analysis involved the use of descriptive statistics and mean comparisons with independent t-tests. Physical performance and psychological outlook were perceived as among the greatest benefits of physical exercise amongst the sample, whereas physical exertion and lack of facilities were perceived as the strongest barriers to physical exercise. Overall, undergraduate students perceived participating in exercising to have more benefits than adverse effect. In this regard there were no significant differences between first year and senior students. These results were similar to those of a study conducted in Glasgow, Scotland amongst tertiary students (Bleakney, 2019).

Kgokong and Parker (2020) conducted a study with the aim of describing the perceived benefits and barriers to exercise and their association with levels of physical exercise and activity in physiotherapy students attending tertiary institutions in the Western Cape Province of South Africa. This study was a quantitative in approach and cross-sectional, survey in design. Two hundred and ninety-six (296) participants were recruited from three universities in the Western Cape. Participants completed a demographic questionnaire (DQ), the Exercise Benefits and Barriers Scale (EBBS) and the International Physical Activity Questionnaire (IPAQ). The results of this research indicated that female students accounted for 83% of the sample. Out of the 296 participants, 58% lived off-campus and 65% were involved in sporting activities for six hours per week. The median score on the EBBS was 136 (54–167) for all years. Responses with the highest agreement for perceived benefits were

associated with physical performance. Alternatively, responses with the highest agreement for perceived barriers were associated with physical exertion. Only 37.5% students engaged in high exercise. It was concluded that undergraduate physiotherapy students in the Western Cape across the institutions who participated did not engage in adequate exercise or physical activity.

3.11 Covid-19 and depression, anxiety and/or self-esteem amongst students

The data for this study were collected five weeks before lockdown for the COVID-19 pandemic in 2020 thus it had no impact on this research. No research could be found that included physical exercise during Covid-19 and its impact on anxiety, self-esteem, and depression amongst students. It was however, considered important to include research on how the lockdown affected students' levels of depression. In this regard, the following paragraphs reveal that students' levels of depression and anxiety were higher during this period owing to their inability to socialise and exercise.

Savitsky et al. (2020) conducted a cross-sectional study amongst all 244 students in the nursing department of a college during the third week of a national lockdown in 2020. The objective of this study was to assess levels of anxiety and ways of coping among nursing students in Ashkelon Academic College, Southern District, Israel. Anxiety level was assessed using the GADS (7-item) with a cut-off point of 10 for moderate anxiety and 15 for severe anxiety. Factor analysis was used to identify coping components. The prevalence of moderate and severe anxiety was 42.8% and 13.1% respectively. Gender, lack of Personal Protective Equipment (PPE), and fear of infection were significantly associated with a higher anxiety score. Stronger resilience and use of humour were associated with significantly lower anxiety levels, while mental disengagement was associated with higher anxiety levels. In conclusion, it was stated that the nursing department's staff could contribute to lowering nursing students'

anxiety by maintaining a stable educational framework, providing high quality distant teaching, and encouraging and supporting students through this challenging period.

Islam et al. (2020) conducted a study with the purpose of investigating the prevalence of depression and anxiety among Bangladeshi university students during the COVID-19 pandemic. It also aimed at identifying the determinants of depression and anxiety in this sample. A total of 476 university students living in Bangladesh participated in this cross-sectional web-based survey. Despite some limitations, this study gave the first empirical evidence that a large percentage of Bangladeshi university students suffered from depression and anxiety symptoms during the ongoing pandemic. In addition to academic and professional uncertainty, financial insecurity also contributed to the rise of depression and anxiety amongst this group. The research recommended that in order to minimise growing mental health problems amongst students, the government, along with universities, should work together to deliver psychological support to them.

Pretorius and Padmanabhanunni (2021) carried out a study that investigated loneliness, anxiety, and life satisfaction amongst a sample of young adults in South Africa during the COVID-19 pandemic, as well as the role of fortitude in the interrelationship between these variables. Fortitude refers to the psychological strength needed in order to manage stress and stay well. It is derived from positive appraisals of self, family, and support from others. The study participants were young adults enrolled in undergraduate studies at a university in the Western Cape Province. The survey was completed during the period of national lockdown from March to June 2020. Young adults are a particularly vulnerable group who have been uniquely affected by the COVID-19 pandemic and pandemic-related preventive measures such as the closure of universities, economic decline, rising unemployment, and job insecurity. This study used a cross-sectional survey research design, and participants (N = 337) were randomly sampled (95% confidence level and 6% confidence

interval) from the university student population. The results demonstrated unprecedented levels of anxiety, loneliness, and reduced life satisfaction among the sample. These levels were significantly higher than those encountered in previous studies in other contexts, as well as in studies of similar populations conducted during the COVID-19 pandemic. Female students reported higher levels of psychological distress than men. The results confirmed the mediating role of fortitude; however, they also suggested that the predictors of psychological distress mediated this pathway, and that fortitude is a causal antecedent to loneliness and anxiety. These findings suggest an impending mental health crisis among young adults in South Africa.

The following section looks at guidelines for physical exercise amongst students as it is important that these are considered in the ambit of this study. No guidelines for students worldwide could be found which is a significant gap in institutional culture. However, physical exercise guidelines were perused in order to help in the practical application of this research, that is providing exercise guidelines for first year students.

3.12 Guidelines for physical exercise amongst students

The following paragraphs give guidelines for physical exercise amongst the age group first year students fall into. Firstly, the WHO (2021) guidelines are provided which include those for pregnant women, those living with a disability and people living with chronic diseases. The policy briefing for physical activity for health in Africa report is also presented followed by exercise guidelines from the Department of Health (DoH), South Africa. No such guidelines were in place at the UNIVEN, where this research was undertaken, at the time of the study.

3.12.1 World Health Organisation (2021) guidelines for physical exercise

The recommended guidelines for exercise and/or physical activity for the age group that the majority of first year students fall into is provided by the WHO (2021). This also considers both young and older first-year students as well as those who may be pregnant, living with a disability or who are living with a chronic condition. These guidelines show how important it is to maintain levels of physical exercise and activity.

3.12.2 Adults aged 18–64 years (students fall within this age range)

The WHO (2021) recommends that adults in this age group should do at least 150–300 minutes of moderate-intensity aerobic physical activity or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equal mixture of moderate- and vigorous-intensity activity during the week. They should also do muscle-strengthening activities to a moderate or greater amount which includes exercising all main muscle groups, on 2 or more days a week, as this offers extra health benefits. Moderate-intensity aerobic physical activity can rise to more than 300 minutes; or more than 150 minutes of vigorous-intensity, aerobic physical activity; or an equal mixture of moderate- and vigorous-intensity activity during the week for further health benefits. This age group should also limit the time they spend being inactive. Substituting inactive time with physical activity of any intensity (including light intensity) provides health benefits. To decrease the harmful effects of inactivity on health, all adults and elder adults must aim to do more than the suggested levels of moderate- to vigorous-intensity physical activity.

3.12.3 All pregnant and postpartum women without any comorbid disorder

This group according to WHO (2021) should, if overall health allows, perform a minimum of 150 minutes of moderate-intensity aerobic physical activity during the week. They should include a variation of aerobic and muscle-strengthening activities. This group should also limit the volume of time they spend being inactive. They should substitute sitting

time with physical activity of any amount (including light intensity), as all exercise and activity offer health benefits.

3.12.4 People living with chronic conditions (hypertension, type 2 diabetes, HIV, and cancer survivors)

The World Health Organization (WHO, 2021) recommends that this group (with medical permission) should perform at least 150–300 minutes of moderate-intensity aerobic physical activity or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or an equal mixture of moderate- and vigorous-intensity activity during the week. They should also do muscle-strengthening activities to a moderate or greater intensity that include all the main muscle groups on 2 or extra days a week, as this offers extra health benefits.

As part of their daily physical activity, older adults living with a chronic disorder, must do mixed multi-component physical activity/exercise that highlights stability and strength exercises to a moderate or greater intensity, on 3 or more days a week, to improve exercise efficiency volumes and to avoid falls. Moderate-intensity aerobic physical activity may rise to more than 300 minutes; or more than 150 minutes of vigorous-intensity aerobic physical activities; or an equal mixture of moderate- and vigorous-intensity activities during the week for extra health benefits. They should reduce the volume of time spent being inactive. Substituting sitting time with physical activity/exercise of any amount (including light intensity) offers health benefits, and to aid decrease the damaging effects of high levels of inactivity on health, all adults and older adults should try and perform more than the suggested levels of moderate- to vigorous-intensity physical activity recommended.

3.12.5 Adults living with disability:

This group must perform at least 150–300 minutes of moderate-intensity aerobic physical action, or at least 75–150 minutes of vigorous-intensity aerobic physical activity; or

an equal mixture of moderate- and vigorous-intensity activity during the week. They should also perform muscle-strengthening activity to an adequate or greater intensity that includes all main muscle groups on 2 or more days a week, as these offer extra health benefits. As part of their daily physical activity, older adults must perform mixed multi-component physical activity that highlights useful balance and strength exercise at adequate or greater intensity, on 3 or more days a week, to improve useful ability and to avoid falls. This may rise to moderate-intensity aerobic physical activity to more than 300 minutes; or more than 150 minutes of vigorous-intensity aerobic physical action; or an equal mixture of reasonable- and vigorous-intensity activity during the week for extra health benefits. They should decrease the volume of time spent being inactive. Substituting inactive time with physical activity or exercise of any type (including light intensity) offers health benefits, and to aims to decrease the harmful effects of high levels of inactivity on health. All adults and older adults should aim to perform more than the suggested levels of moderate- to vigorous-intensity physical activity. They should try not to be inactive and try and do some form of physical exercise or activity when sitting or lying for example, upper body activities and inclusive and/or wheelchair-specific sports and activities (WHO, 2021).

3.12.6 Physical activity for health in Africa: guidance during and beyond the COVID-19 pandemic

The physical activity for health in Africa policy brief (2020) prepared by physical exercise experts across the African continent, serves to guide decision makers, planners, and programme leaders, both during the COVID-19 pandemic and beyond. More than ever, the COVID-19 pandemic has highlighted the need to prioritise physical exercise as an imperative for public health in Africa. With nearly 30% of the disease burden in sub-Saharan Africa attributable to non-communicable diseases (NCDs), which are associated with an increased risk of hospitalisation and mortality in patients with COVID-19, the urgency of interventions

is escalated. Approximately 18% of men and 25% of women in Africa are still insufficiently physically active to protect them from NCDs. In the African policy on physical activity/exercise for health, a framework for the implementation of some type of exercise is offered, providing various local and global examples of approaches to promote and integrate physical activity and exercise opportunities that address social, environmental, and economic inequalities. This framework is aligned to the World Health Organization Global Action Plan for Physical Activity (GAPPA) and is relevant both during and beyond the COVID-19 pandemic. These guidelines encompass those for children and adolescents (a classification some tertiary education students fall into as they are 18 years old). There are also guidelines for African communities. A section from the document (Policy Brief: Physical activity and health for children and adolescents in Africa, 2013, p.9).

Age-appropriate physical activity and physical literacy practices encourage activities that promote cardiovascular fitness and strength but maintain social distancing, e.g., aerobics, dance, high intensity-interval training, hopping, and jumping. Activities and games that promote agility, balance, co-ordination, and speed but maintain social distancing should be encouraged. Encourage activity circuits that incorporate mobility, strength, power, endurance, and cardiovascular fitness. Encourage sport-specific activities and drills for older children and adolescents that can be performed while observing social distancing and appropriate sanitising and use of equipment.

Discussing the whole document is beyond the scope of this research however, it can be accessed on: <https://www.samrc.ac.za/sites/default/files/attachments/2020-10-15/PhysicalActivityChildren.pdf>. The document highlights how physical activity and exercise play a vital role for well-being during the current pandemic and in creating a healthy future for the African region.

3.12.7 Guidelines for physical exercise and/or activity amongst students in South Africa

No guidelines could be found and, indeed, only one recent study was found relevant to the topic of this research. This research by Gresse et al. (2015) compared the eating patterns, alcohol consumption and physical activity of Health Science students with those of other students at a South African tertiary institution. A cross-sectional study design that utilised an electronic self-administered survey was used to collect data which were analysed using tests such as Pearson's chi-square test. A convenience sample (n = 619), consisting of registered students at Nelson Mandela Metropolitan University (NMMU) participated in the research after giving informed consent. Dietary patterns and frequency of intake, alcohol consumption and physical activity were measured. The results of this study reported no statistical differences between the eating patterns, alcohol consumption and the physical activity of Health Science students and students registered in other faculties. Most of the students exhibited poor dietary behaviour. For example, 65% of Health Science students and 67% of students in other faculties consumed less than one fruit per day; 70% of Health Science students and 64% of other students consumed less than one vegetable per day, while 91% of Health Science students and 93% of students in other faculties consumed less than two glasses of milk per day. Although not significant, fewer Health Science students (4%) than students in other faculties (9%) consumed alcohol more than twice a week. Binge drinking was, however, more common in Health Science students than other students. Forty-eight percent (48%) of the Health Science students indicated that they were physically inactive, compared to 49% of students in other faculties. It was concluded in this study that students studying Health Science do not have a healthier lifestyle than other students. Researchers recommended further theory-based intervention studies need to take place to determine the reasons for these behaviours. The research also recommended that strategies

should be developed to encourage behavioural change in terms of healthier eating and exercise regimes amongst students.

According to Gresse et al. (2015), universities are responsible for the holistic education of students which should include overall physical and psychological well-being, extra-curricular interventions should also be considered. These campaigns should promote healthier food choices and explain the practical implication of poor food choices to students throughout the university as well as the benefits of exercise. Peer pressure plays an important role in risky health behaviour with respect to alcohol intake. Motivational campaigns should be introduced to strengthen the message that students are not less popular if they choose not to consume excessive quantities of alcohol. More research on the impact of various factors, such as the availability of food, financial constraints, and culture, is also necessary. Although the authors intended to introduce awareness campaigns at NMMU, and continue with theory-based intervention research, there is a critical need for earlier modification by targeting school children with the use of awareness campaigns which may be of more value. The need for continuous longitudinal monitoring of risky health behaviour by students, and of their well-being should also take place.

3.12.8 Important considerations when developing guidelines for physical exercise amongst students

The first thing that must be stated is that tertiary institutions that do not have programmes in Human Kinetics and Ergonomics (HKE) and/or Sports Science and/or Biokinetics do not have people who are skilled in providing guidelines for regular exercise. In developing institutions this is usually the case for instance, neither UNIVEN nor the University of Limpopo have these programmes. There is no doubt that experts in physical education and/or sports scientists and/or Biokineticist's are needed in developing institutions. According to Nel (2014) and Ellapen et al. (2014), a Biokineticist is an exercise specialist

who helps individuals improve an individual's physical condition and thus their life-quality. They do this by assessing an individual's level of fitness and prescribing specific exercise routines to help them improve it. They can also help with the rehabilitation of sports injuries. There is little doubt that Biokineticist's should be employed at every tertiary institution to address these issues. There are many areas that are subsumed under the guidelines of physical exercise which include the following as adapted from Robinson et.al. (2015); Logan et al. (2018); Pangrazi and Dauer (2013) and Pangrazi and Beighle (2019).

1. Fundamental motor skills which include:

- Locomotor skills such as walking, running, hopping, skipping, jumping, leaping, sliding, and galloping.
- Non-locomotor skills such as bending, twisting, turning, rocking, balancing, stretching, pushing, and pulling and
- Manipulative skills for instance, striking, rolling kicking catching, bouncing, trapping, and throwing.

2. Movement concept skills

- Body awareness, spatial awareness, qualities of movement and relationships.

3. Rhythmic motor skills – performance of motor skills in a rhythmic manner.

4. Specialised motor skills – used in particular sports such as tumbling in gymnastics, and manipulative activities such as rope jumping.

5. Health related physical fitness and wellness this includes, knowledge of health-related fitness components, ability to do fitness self-testing, participation in regular fitness activity, identification of personalised fitness activities and understanding the components of wellness generally.

6. Human movement principles – anyone involved in making generalised or individualised fitness programmes must know basic kinesiology principles including stability, force, and

leverage. They must also know the elementary principles of physiology including body composition, training zones and strength development.

7. Social skills and positive self-concept – an individual needs to develop interactive skills such as the ability to lead and follow, develop decision making skills and be able to exchange these ideas with other students. They should acquire skills of cooperation such as the ability to follow directions, be accepting of individual differences and have the ability to be a team ‘player.’ They should also be able to show sportsmanship behaviours including a sense of fair play, self-discipline and develop the ability to win and lose with dignity.
8. Lifetime participation in exercise or some form of physical activity – an individual should develop competency in different motor skills and participate in physical exercise or activity that are suited to their personal competencies. Importantly, they should understand the social and physical benefits of lifetime participation in sports, exercise and/or some type of physical activity.

The guidelines developed out of an interpretation of the results of this research and a reading of literature related to the study are thus generic as they address some, but not all of these concepts. An HKE graduate was consulted to ensure that the generic guidelines for undergraduate exercise were appropriate but, as stated, these can be added to, individualised, and built on by appropriate physical exercise professionals.

3.12.9 The knowledge physically educated people should have

According to Pangrazi and Dauer (2013) and Pangrazi and Beighle (2019), physically educated people should have specific knowledge. This type of knowledge is ‘lifelong’ thus it is important that students should acquire it when they are young so that they will lead a physically and cognitively healthy lifestyle. The following table has been adapted from the

American Alliance for Health, Physical Education, Recreation and Dance (AAHPERD, 1995). It is still used and is applicable today.

Defining the knowledge of the physically educated person

A physically educated person has learned skills necessary to perform a variety of physical activities	<ol style="list-style-type: none">1. Moves using concepts of body awareness, space awareness, effort, and relationships.2. Demonstrates competence in a variety of manipulative, locomotor, and non-locomotor skills.3. Demonstrates competence in combination of manipulative, locomotor, and non-locomotor skills performed individually and with others.4. Demonstrates competence in many different forms of physical activity or exercise.5. Demonstrates proficiency in a few forms of physical activity or exercise.6. Has learned how to learn new skills.
Is physically fit	<ol style="list-style-type: none">7. Assesses, achieves, and maintains physical fitness.8. Designs, or has someone design, safe personal fitness programmes in accordance with the principles of training and conditioning.

Participates regularly in physical exercise and/or activity

Knows the implications of, and the benefits, from involvement in physical activities.

9. Participates in health-enhancing physical activity at least three times a week.
10. Selects and regularly participates in lifetime physical activities.
11. Identifies the benefits and costs and obligations associated with regular participation in physical exercise or activity.
12. Recognises the risk and safety factors associate with regular participation in exercise or physical activity.
13. Applies concepts and principles to the development of motor skills (either unaided or with the help of a professional).
14. Understands that wellness involves more than being physically fit.
15. Knows the rules, strategies, and appropriate behaviours for selected exercise activities (or physical activities).
16. Recognises that participation in physical exercise or activity can lead to multi-cultural and international understanding.
17. Understands that physical exercise or activity provides the opportunity for

	enjoyment, self-expression, and communication.
Values physical exercise and activity and its contributions to a healthy lifestyle.	<p>18. Appreciates the relationship from participation in physical activity.</p> <p>19. Respects the role that regular physical exercise or activity plays in the pursuit of life-long health and well-being.</p> <p>20. Likes the feelings that result from regular participation in physical exercise or activity.</p>

Table 3: Definition of the physically educated person (AAHPERD, 1995)

3.13 Summary

This chapter discussed literature relevant to the study. Generally, literature suggests that individuals who are not involved in any physical exercise show reduced levels of self-esteem, more depression and anxiety and are more prone to other mental illnesses. Guidelines for physical exercise and activity were also discussed. The following chapter (4) presents a detailed account of the research methodology used in the study.

CHAPTER 4

RESEARCH METHODOLOGY

4.1 Introduction

This chapter gives a comprehensive account of how the research was conducted. It gives an overview of the research design, sampling, data collection, tools used for data collection, data analysis, research hypotheses, reliability, validity, and bias. It also gives the ethical considerations for the study.

4.2 Research design

The research adopted a quantitative approach using a cross-sectional survey design which is a type of quasi-experimental research design. This type of design is where researchers collect data from many individuals at a single point in time in this way variables are observed but not influenced in any way (Babbie, 2020). It was also appropriate because according to Thomas (2022) it is a relatively inexpensive and fast mode of data collection which, under the social circumstances at the time of the research (just before the COVID-19 lockdown) was considered suitable.

The research design was thus considered appropriate for the current study in that the research accumulated data about specific issues (depression levels, anxiety, and self-esteem), in a defined population (exercisers and non-exercisers) at a specific moment in time.

4.3 Area of the study

The research took place at the University of Venda (UNIVEN) which is a rural-based university, located in Thohoyandou in Limpopo Province. This institution is a historically disadvantaged university and has a predominately Black African demographic. The year the research took place the University enrolled +- 1 900 first year

students, most of whom were Black African, there were a very small number of Indian and White students (Personal Communication, the Registrar, University of Venda, 2019).



Figure 2: A South African map showing the province and district (red on the map) where the study was conducted (Wikimedia, 2011)

4.4 Sampling

4.4.1 Population

The population was all first-year undergraduate students registered at UNIVEN.

4.4.2 Sampling method

Simple random sampling was used for the study. There were 1, 900 registered first year students registered at UNIVEN when the research took place (Personal Communication Office of the Registrar, UNIVEN, 2019). First year students who did not participate in any exercise activities were found during orientation. The researcher attended orientation and asked students who did not exercise at all to take part in the study by enlisting their email addresses on a designated list, placed on a noticeboard outside their faculties, stating non-

exercising students. The active or exercising students were found the same way. In all the researcher received 1, 300 email addresses of students who agreed to participate in the study. The returned protocols were then stratified into two groups namely, those who engaged in physical exercise on a regular basis and those who did not. Exercisers and non-exercisers were defined as follows.

a) All first-year students (male and female) who participated in physical exercise that was undertaken on a regular basis that is, three times a week for about thirty minutes over a period of two months or more

b) The sample of non - exercisers both male and female, were defined as those who did not take part in any physical sporting code or participate in any fitness exercises or activities. Participants were male and female.

4.4.3 Sample size

In 2019 there were +1, 900 first-year students registered at UNIVEN. Using Morgan and Krejcie's (1970) table, a sample of 320 was deemed representative of this population. This table was used as, at the time of data collection, the researcher did not have access to Raosoft software which calculates sample size.

To ensure that simple random sampling for the study could be properly constituted and to account for attrition 300 exercisers and 300 non-exercisers were randomly identified from the email lists and protocols emailed to them. Linear simple random sampling was then used to find the designated sample of 320. In this regard: 1) the lists of 300 exercisers and 300 non-exercisers were used; 2) the final sample size of exercisers and non-exercisers was calculated, by the statistician using Raosoft software which calculates sample size. The final sample was 160 exercisers and 160 non-exercisers.

Table 3.1									
<i>Table for Determining Sample Size of a Known Population</i>									
N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	354
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	191	1200	291	6000	361
45	40	170	118	400	196	1300	297	7000	364
50	44	180	123	420	201	1400	302	8000	367
55	48	190	127	440	205	1500	306	9000	368
60	52	200	132	460	210	1600	310	10000	370
65	56	210	136	480	214	1700	313	15000	375
70	59	220	140	500	217	1800	317	20000	377
75	63	230	144	550	226	1900	320	30000	379
80	66	240	148	600	234	2000	322	40000	380
85	70	250	152	650	242	2200	327	50000	381
90	73	260	155	700	248	2400	331	75000	382
95	76	270	159	750	254	2600	335	100000	384

Note: N is Population Size; S is Sample Size *Source: Krejcie & Morgan, 1970*

Table 4: Morgan and Krejcie’s (1970) table for estimating sample size

4.4.3.1 Exclusion criteria

1. A student who had been previously diagnosed with any form of depression or anxiety disorder.
2. A student who could not exercise due to a medical/physical/psychiatric condition.
3. A student, who at the time of the research was taking medication for depression, anxiety, or any other psychotropic medication, and individuals who were previously diagnosed with depression or PTSD were excluded because, with or without exercise they were likely to display symptoms of depression and PTSD. This avoided bias in the research.

4. All students who were not first-year. First year students according to the objectives of this study, are faced with challenges of a new environment, adjustment issues and academic demands, any student who was not first-year was not allowed to participate to ensure reliable results.

4.4.3.2 Inclusion criteria

1. All registered first-year students who took part in physical exercise which was defined as that which commenced on a regular basis, that is, three times a week for thirty minutes or more over a period of two months or more.
2. Respondents who were defined as first-year students who did not take part in any form of physical exercise for two months or more preceding and/or during the research.

4.5 Data collection

Data were collected from the two groups namely, the regular exercise group and the group of those who did not engage in any physical exercise. The researcher approached the Registrar at UNIVEN and gained permission to speak to the students about participating in the study during their first-year orientation.

The researcher went to orientation week for each faculty and informed students about the research. He asked students who did not do any exercise and those who exercised (with the explanation about what exercise was as per the research definitions), and who were interested in participating in the research, to enlist their student numbers and email addresses onto the forms. One form was for exercisers and one for non-exercisers, these were placed on boards outside of the different faculties. From these lists the researcher generated a random list of non-exercisers and exercisers. A higher number of randomised student numbers than required was generated to account for non-response (300 exercisers and 300 non-

exercisers in total). The protocols were then emailed to the identified students, and they were asked to return the completed surveys into boxes that were placed outside of each faculty block. The researcher picked up the completed protocols weekly for a period of 5 weeks before the COVID-19 lockdown. As lockdown happened 4 weeks post-data collection it is unlikely that the pandemic had any effect on this research, in terms of higher levels of anxiety and/or depression amongst students.

4.6 Research instrument

4.6.1 The Becks Anxiety Inventory (BAI) – See appendix 1

The Becks Anxiety Inventory (BAI) was developed by Aaron T. Beck and Robert A. Steer in 1993. It measures severity of anxiety in adults and adolescents 17 years and older. The administration of the test takes 5 to 10 minutes. The BAI is a standardised, self-report measure for anxiety. It is a 21-item multiple-choice self-report inventory which measures the severity of anxiety. Because the items in the BAI describe the emotional, physiological, and cognitive symptoms of anxiety but not depression, it can discriminate anxiety from depression. The items on the BAI are all related to feelings of anxiety thus were appropriate for this research. It takes up to ten minutes to complete which is a relatively short period for a standardised questionnaire. It is easy to administer and has proven validity across cultural groups (Beck et al., 1988; Nel & Tshikovhele, 2018). Questions are easy to understand across cultural groups. A Likert type scale is used and the respondent circles appropriate blocks or headings for the scale. Responses include: ‘feeling hot, numbness or tingling, unable to relax.’

Internal consistency (Cronbach’s Alpha) on the protocol ranges from .92 to .94 which is good, and the test-re-test reliability is acceptable (Fydrich et al., 1992). The Cronbach α (internal consistency) for the BAI for the present sample was calculated at 0.90.

4.6.2 The Beck's Depression Inventory - 11 (BDI-11) – See appendix 1

The BDI -11 is used to screen for depressive symptomology and was originally introduced by Beck et.al. in 1961 and was later revised. The BDI - 11 is a 21 item self-report rating inventory measuring different types of symptomologies related to depression. It is a self-administered questionnaire which takes about ten minutes to complete. Questions in the scale are easy to understand across cultural groups for instance, “I do not feel sad,” and “I feel sad much of the time.”

It has been noted as reliable and valid in South African contexts (Pillay et al., 2002). On the other hand, Makhubela (2015) and Rousseau et al. (2020) report that not enough is researched concerning its psychometric properties in non-western samples. However, for this research, using the Pillay et al. (2002) findings, it was considered acceptable. Wang and Gorenstein (2013) indicate that over different studies globally the Cronbach Alpha for the BDI has been estimated at 0.85 to 0.96. The Cronbach α (internal consistency) for the BDI-11 for the present sample was calculated at 0.94.

4.6.3 The Rosenberg Self-Esteem Scale - See Appendix 1

The Rosenberg Self-Esteem Scale (RSES) is made up of 10 items that refer to self-respect, self-esteem, and self-acceptance. It uses a 4-point Likert-type scale for its items. It measures, at a precise point in time, how individuals feel about themselves as compared to others essentially, the scale measures self-esteem (Rosenberg, 1965). Examples of questions on the scale are: “On the whole, I am satisfied with myself,” and “I am able to do things as well as most other people.” The questions are easy to understand across cultures. The internal consistency (Cronbach alpha) has been measured consistently at .83 to .88, which is acceptable to good (Lazarević et al., 2017; Tagarro & Galinha, 2016). A Cronbach Alpha of .81 was found using a representative South African sample, which is acceptable to good

(Ndima, 2017). The Cronbach α (internal consistency) for the RSES for the present study was calculated at 0.81.

4.7 Data analysis

The study used descriptive (mean, percentages, and graphs) and inferential statistics that is a Multivariate Analysis of Variance (MANOVA) and logistic regression analysis to give a well-defined picture of the data. In this regard, logistic regression analysis was used to analyse relationships between independent variables in order to predict dependent data variables (Babbie, 2020). Inferential statistics are used to draw conclusions and/or to make predictions inherent to a population based on collected data (Babbie, 2020; Bryman & Cramer, 2009). They are also used to investigate differences between and amongst groups. A MANOVA is performed when several variables both dependent and independent are present, which is the case in the present research. Descriptive statistics, that is non-inferential statistics, were used to give a general overview or picture of the data in numeric and graph format.

4.8 Hypotheses

Ho1: Students who exercise regularly have more positive self-esteem than students who do not exercise regularly.

Ho2: Students who regularly have fewer depressive indicators than students who do not exercise regularly.

Ho3: Students who exercise regularly have less anxiety symptoms than students who do not exercise regularly.

It must also be specified that one of the study objectives, which could not be hypothesised, was to update any existing guidelines for exercise at UNIVEN and/or produce a set of guidelines for exercise at the institution.

4.9 Reliability, validity, and bias

4.9.1 Pilot study

A pilot study was conducted on 30 respondents (15 exercisers and 15 non-exercisers) to ensure the accuracy and non-biased nature of the questionnaire. Cronbach alpha was also computed to confirm the reliability and validity of the questionnaires. Cronbach alpha for the entire protocol was .90 which is excellent in terms of internal reliability. No problems were found with questions on the protocol and the pilot study questionnaires were not used in the final sample.

4.9.2 Reliability

According to Bless et al. (2013), reliability is concerned with the consistency of measures. An instrument that produces different scores whenever it is employed to measure an unchanging value has low reliability. It cannot be relied upon to give an accurate measurement. On the other hand, an instrument that continually gives the same score when employed to measure a fixed/unchanging value can be trusted to give a correct measurement and is said to have high reliability (Babbie, 2020). In this study the surveys used are standardized and thus reliable and valid.

4.9.3 Validity

A test cannot have high validity unless it also has high reliability. It is important for a test to be valid for the results to be accurately interpreted and applied (Babbie, 2020). Fundamentally, according to Bless et al. (2013) it is the extent to which any concept (such as in the present study self-esteem, depression, and anxiety) is accurately measured in a study using a quantitative approach. The tests used are standardised and thus have been used over time, in different populations, and are thus reliable and valid.

4.9.4 Bias

Babbie (2020) states that bias is related to any error that occurs in a psychometric testing process that can be avoided. For instance, administrative error in this research was controlled by ensuring that the protocols were sent out per email to the sample at the same time on the same day. Sampling bias was controlled for as random sampling was utilised. In this research standardised measures were used to ensure there were no poorly worded questions. The protocols were self-report in nature and were filled in when the respondents had time. They all had a covering letter which also helped control administrative bias. Ethical considerations

4.10 Ethical issues

Ethics refers to the correct rules of conduct necessary when carrying out research. Researchers have a moral responsibility to protect research respondents from harm. The purpose of these codes of conduct is to protect research respondents, the reputation of psychology, and the researchers themselves. Protection of human subjects is an ethical mandate for all contemporary research involving human subjects (Tsan & Nguyen, 2019). Ethical guidelines as laid down by the Health Professions Council of South Africa (Psychology Division) were followed when conducting this research (See Appendix 4).

4.10.1 Permission to conduct the study

Permission to conduct the study was given by the University of Limpopo Research and Ethics committee (Turffloop Research and Ethics Committee [TREC]), after which permission was sought, and given, through relevant committees at the University of Venda (UNIVEN). The ethical clearance number for the present is: TREC/349/2019: PG.

4.10.2 Informed consent

Informed consent can be defined as a procedure in which individuals learn important details about the research, including risks and/or benefits to themselves, before choosing whether or not to take part in a study (Tsan & Nguyen, 2019). According to Babbie (2020), where information is collected from human respondents, other than in very particular circumstances, informed consent must be obtained. Furthermore, where the research exposes respondents to a risk of harm, the researcher has an ethical obligation to consider these risks, even when the participant has consented to participate in a study.

The respondents were told about what informed consent means and thereafter asked to fill in consent forms approved by the University of Limpopo ethics committee. This was included in the research protocol the respondents received. A covering letter informed respondent about the research and reasons for it. The letter also informed respondents that they could withdraw from the research at any time. Respondents were also informed about the research and its aims and objectives in their first-year orientation as the researcher was allowed to present his intention to do research to different faculties at UNIVEN.

4.10.3 Voluntary participation

No respondents were coerced to take part in the study (Babbie, 2020). The respondents consented and, if they changed their minds, they were told that they did not have to hand the protocol in. The respondents needed to understand their role and the nature of the study to be fully aware of what the research entailed. These details were provided with the protocol they received as well as face-to-face during orientation week.

4.10.4 Confidentiality and anonymity

Researchers should ensure that confidential information is protected, and guard sensitive information obtained in research. When gathering confidential information,

researchers must consider the long-term usage of the information, including its potential placement in public archives, or the examination of the information by other researchers (Babbie, 2020).

Confidentiality was ensured as the researcher informed the respondents that their names would not appear in the research and that all returned questionnaires would be kept, in a locked filing cabinet, at the office of his supervisor. This was stated during his face-to-face meetings with first years in orientation week and appeared on the research protocol they received. Anonymity was guaranteed as none of the respondents' names appeared in the finished PhD or journal article (Babbie, 2020).

4.10.5 Deception

According to Babbie (2020), researchers should respect the rights, dignity, and worth of all people taking part in research and take care to do no harm in the research process. In their research, they have a special obligation to protect the rights, welfare, and dignity of research respondents throughout a study. The researcher should be sensitive to cultural values and role differences in groups of people with distinctive characteristics. Researchers should at all times strive for honesty in all communications and honesty in reporting data, results, methods and procedures, and publication status. Under no circumstances should the researcher fabricate, falsify, or misrepresent data, nor deceive respondents (Babbie, 2020).

The researcher adhered to the aforementioned concepts when he carried out the research. The researcher did not lie or deceive respondents or manipulate data in anyway. The researcher ensured that the respondents were fully aware of the research rationale and its aims and objectives. The true nature of the study was explained honestly, and any risks explained. The respondents were informed that there was no material benefit for participating in the study.

4.10.6 No harm to respondents

Social research should never subject respondents to harm, regardless of whether they participate voluntarily or not. The responsibility lies with the researcher to look for subtle dangers to respondents and guard against them (Babbie, 2020). The researcher kept this in mind when undertaking this study. The respondents were given the researcher's email address and those of his supervisors and informed they could contact them if they experienced any uncomfortable feelings. However, no respondents reported feeling uncomfortable after filling in the surveys thus did not require any psychological or other interventions.

4.10.7 Right to privacy

The respondents' right to privacy was observed throughout the study. The right to privacy means that a person has the right not to take part in the research, not to answer questions, not to be interviewed, not to answer telephone calls or emails, and to engage in private behavior in their own private place without fear of being observed (Babbie, 2020). Respondents were informed they could withdraw from the research at any time with no 'comebacks.'

4.10.8 Respect

Respondents must be handled with respect to continue to have trust in the researcher and trust in human research generally (Walker, 2020). Respondents and their received protocols were, at all times, treated with respect and dignity. The researcher had due regard for the welfare, beliefs, perceptions, customs, and cultural heritage, of those involved in this research process. The researcher respected the privacy, confidentiality, and cultural sensitivities of the respondents.

4.11 Summary

This chapter presented the research methodology used in this study. It explained the research design, the rationale for the research and population and sample that was included in the study. It also clarified the data collection and analysis procedures. The survey tools used to collect the information were named and described. The chapter further explained issues related to reliability, validity and bias related to the research. Ethical considerations were also discussed. The following chapter (5) presents the research results for the study.

CHAPTER 5

PRESENTATION OF RESULTS AND DISCUSSION

5.1 Introduction

This chapter focuses on the presentation of the research results. The first section of the chapter focuses on the presentation of the demographic results. The second section focuses on the presentation of results that emerged out of a statistical analysis of the data.

The results are presented in graphical and tabular format interpreted from respondents' responses to the three scales used in the study namely the RSES, BAI and the BDI-11. The study used descriptive (mean, percentages, and graphs) and inferential statistics (that is, MANOVA and regression analysis) to give a well-defined picture of the data. Inferential statistics are used to draw conclusions and/or to make predictions inherent to a population based on collected data (Babbie, 2020). They were also used to investigate differences between and amongst groups. A MANOVA is performed when several variables both dependent and independent are present in the study.

5.2 Presentation of research findings

The demographic information of participants is presented first in a graphical format followed by an explanation.

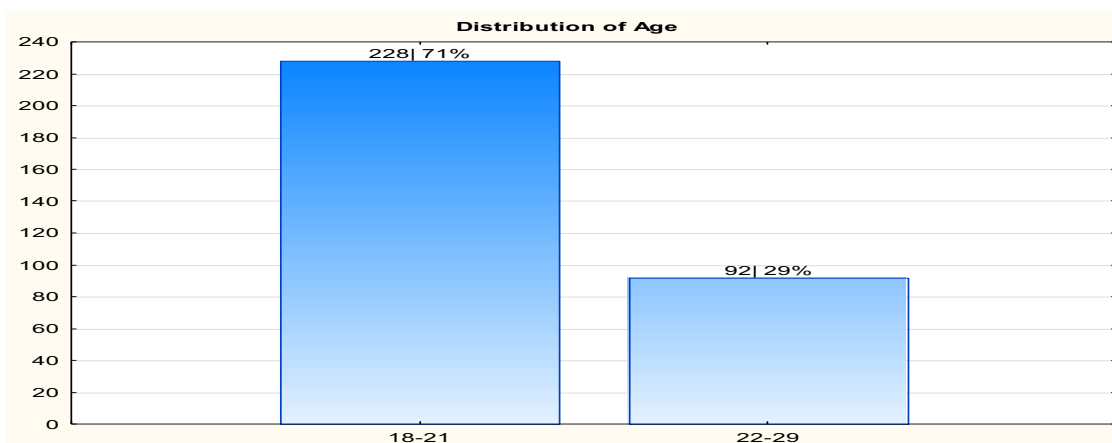


Figure 3: Age of participants

Figure 3 indicates the distribution of age amongst the participants. Two hundred and eighty-eight participants (71%) were between the ages of 18-21 years and 92 participants (29%) were between the ages 22-29years.

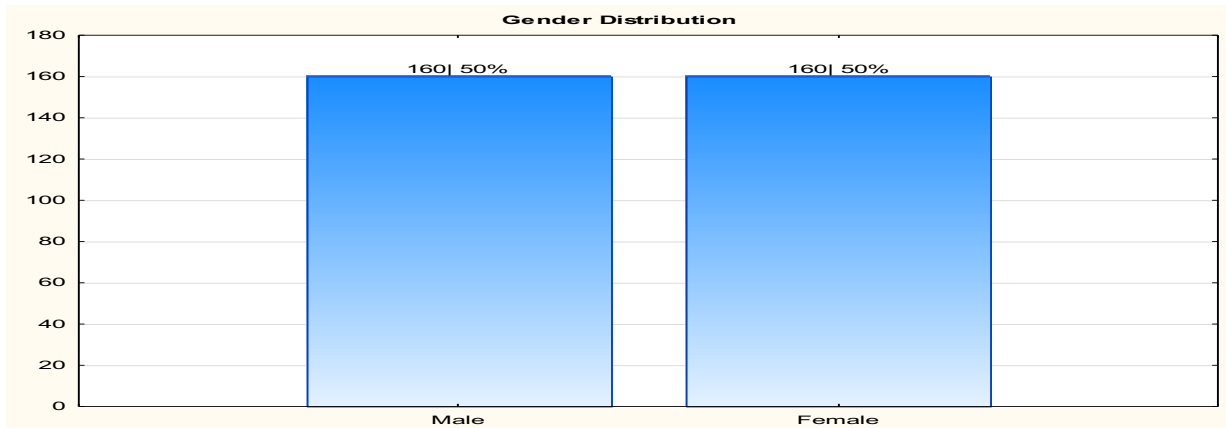


Figure 4: Distribution of gender

Figure 4 indicates the distribution of gender amongst the participants. It is indicated that 160 participants (50%) were females, and 160 participants (50%) were males. Gender groups were not stratified, and it is serendipitous that 50% of respondents were male and 50% female.

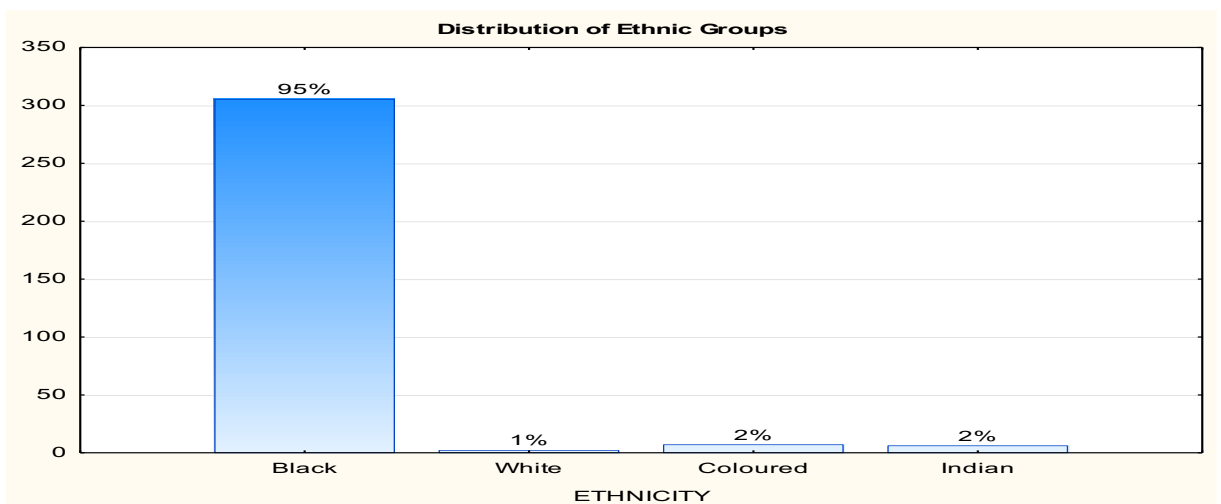


Figure 5: Distribution of ethnic groups

Figure 5 indicates the distribution of ethnic group amongst the participants. It is indicated that 95% of the participants were Black, 1% of the participants were white, 2% of the participants were Coloured and 2% Indian.

5.3 Descriptive statistics and Multivariate Analysis of Variance (MANOVA) results

In this section the descriptive statistics and MANOVA results are presented for the different scales.

The MANOVA was selected as the method of analysis because the dependent variables correlated. When the dependent variables correlate, MANOVA is more accurate and can identify effects that are smaller than those that ANOVA can find. In this research Pearson r results indicated that there is a strong correlation between the dependent variables therefore the use of a MANOVA is indicated as the analysis of choice to compare the means between the groups on the different scales. Pearson's *r*: The Rosenberg Self-Esteem Scale (RSES)– The Beck's Anxiety Inventory (BAI): 0.51*, The Rosenberg Self-Esteem Scale (RSES) – The Beck's Depression Inventory (BDI-11): 0.61*, and the Becks Anxiety Inventory (BAI) – Becks Depression Inventory (BDI-11): 0.64*.

	Wilks	Value	F	df	p	Partially eta squared
Exercise	0.73	38.94	3.310	<0.001**	0.27	
Gender	0.92	9.27	3.310	<0.001**	0.08	
Age	0.99	0.83	3.310	0.48	0.01	
Exercise x Gender	0.97	3.32	3.310	0.02*	0.03	
Exercise x Age	0.99	0.80	3.310	0.50	0.01	
Gender x Age	0.97	3.17	3.310	0.02*	0.03	
Exercise x Gender x Age	0.98	2.51	3.310	0.05	0.02	

Table 5: MANOVA results

Table 5 indicates that there were interaction effects of gender and age therefore all groups had to be analysed separately as indicated in table 6. In this table ** means statistically significant, smaller than 0.001 (**p<0.001) and * means statistically significant, smaller than 0.005 (*p<0.005).

	Exercise N=160 (50%)				No Exercise N=160 (50%)				<i>p</i> < 0.05
	Male		Female		Male		Female		
	N=80 (25%)		N=80 (25%)		N=80 (25%)		N=80 (25%)		
	18-21	22-29	18-21	22-29	18-21	22-29	18-21	22-29	
	N=53 (17%)	N=27 (8%)	N=54 (17%)	N=26 (8%)	N=56 (18%)	N=24 (8%)	N=65 (19%)	N=15 (5%)	
Test	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	
RSES	31.02 (3.69)	31.00 (3.64)	32.37 (4.05)	31.69 (3.43)	22.42 (7.37)	26.63 (5.21)	29.83 (4.34)	28.13 (5.81)	EM > NEM EF > NEF
BAI	14.60 (8.90)	11.59 (7.81)	13.76 (10.40)	13.85 (11.29)	27.66 (14.11)	20.86 (12.75)	25.06 (9.39)	26.07 (12.61)	EMY < NEMY EF < NEF
BDI-II	11.25 (8.87)	9.33 (10.19)	10.96 (11.50)	9.73 (9.27)	31.82 (18.21)	22.33 (15.82)	21.97 (12.22)	28.93 (14.36)	E < NE (All Groups)

Key: E = Exercise: NE = No Exercise: EM = Exercise Males: NEM = No Exercise Males: EF = Exercise Females; NEF = No Exercise females: EMY = Exercise Males, Younger Group: NEMY = No Exercise Males Younger Group.

Table 6: Bonferroni post-hoc analysis

Table 6 presents the descriptive statistics for the Rosenberg Self-Esteem Scale it gives the mean (M) and standard deviation (SD) in connection to the exercise frequency, gender, and age for the sample. The table indicates that 56 males in the 18–21-year age group did not exercise at all while in the 22–29-year age group 24 males did not exercise at all. In the 18–21-year age group 65 females did not exercise at all, while in the 22 – 29-year age group 15 females did not exercise at all. Furthermore, 53 males in the 18-21-year age group exercised. In the 22-29-year group, 27 males exercised. In the 22-29-year age group, 54 females exercised while 26 females in the 18-21-year age group exercised.

5.3.1 Multivariate Analysis of Variance (MANOVA) results for the Rosenberg Self-Esteem Scale (RSES)

Figure 6 illustrates the results of the MANOVA for the RSES. It shows that the group that exercised had significantly higher self-esteem than the group that did not exercise. This was true for both genders. A box plot depicting results for the inventory is included to show current effect and confidence intervals.

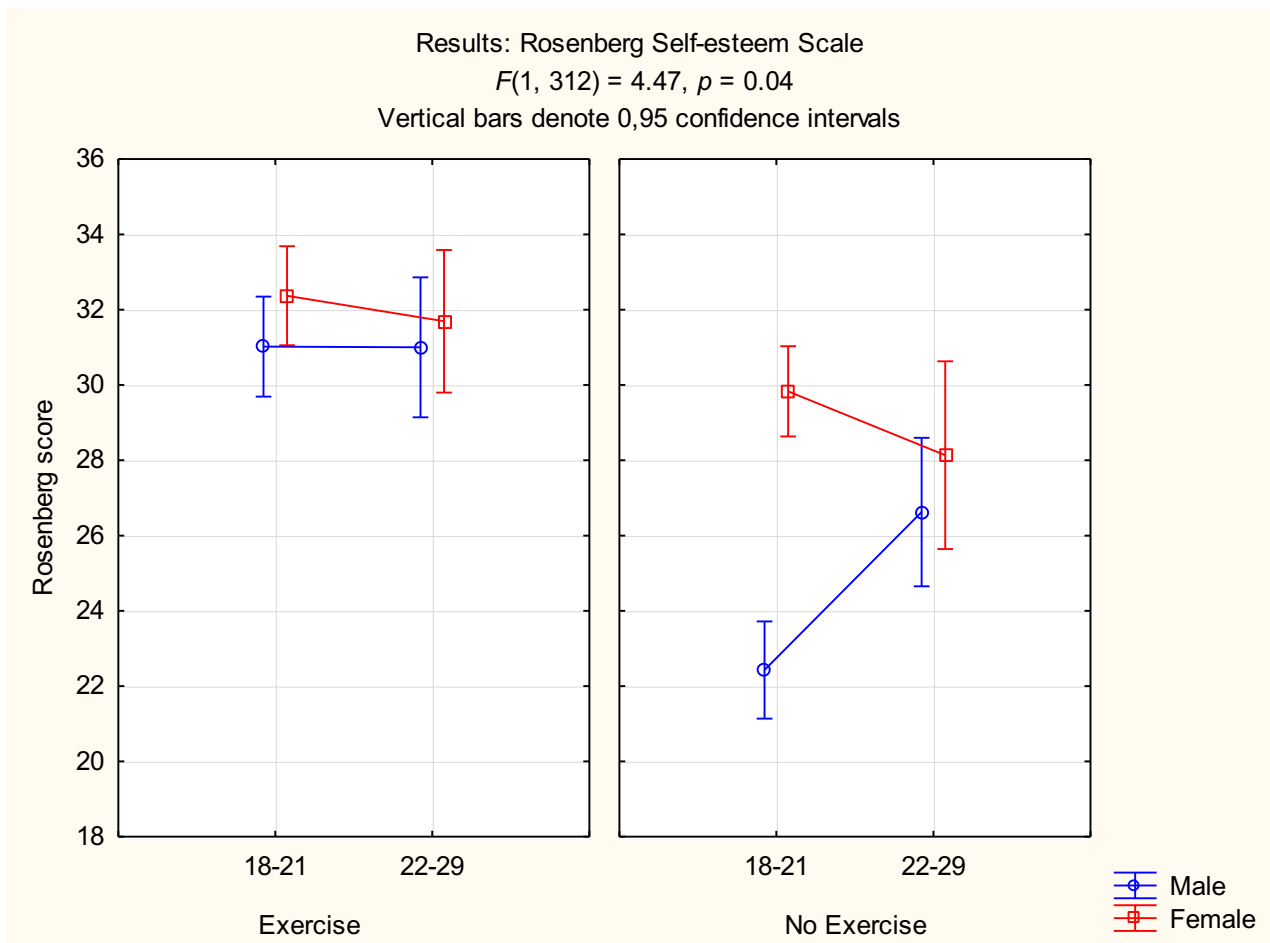


Figure 6: Box plot depicting MANOVA results for the RSES

5.3.2 Multivariate Analysis of Variance (MANOVA) results for the Beck's Anxiety Inventory (BAI)

Figure 7 illustrates the results of the MANOVA for the BAI. This implies that the group that exercised had less anxiety levels compared to those who did not exercise. A box plot depicting results for the inventory is included to show current effect and confidence intervals.

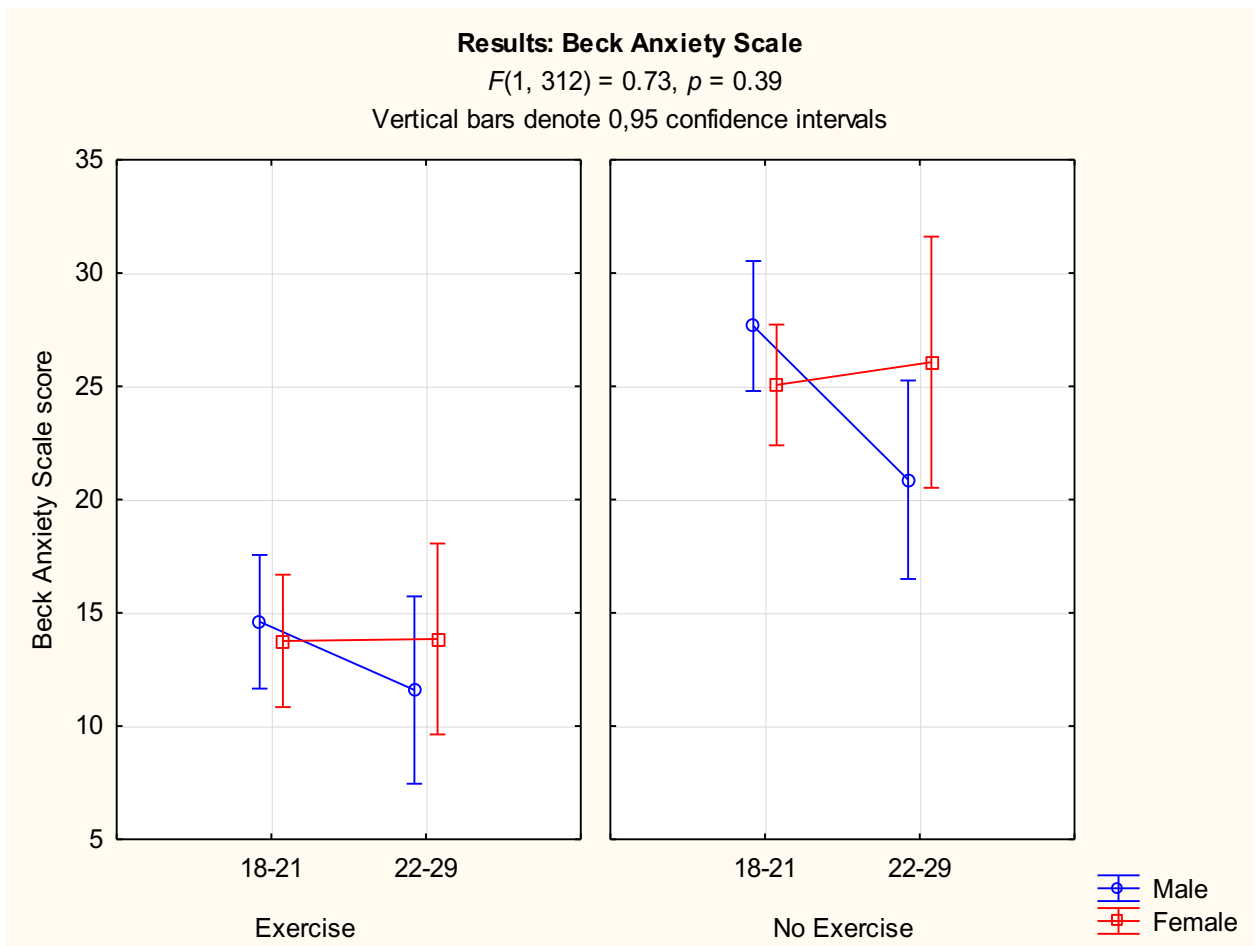


Figure 7: Box plot depicting MANOVA results for the BAI

5.3.3 Multivariate Analysis of Variance (MANOVA) results for the Beck's Depression Inventory – 11 (BDI-11)

Figure 8 illustrates the results of the MANOVA for the BDI-11. Analysis revealed that the groups who did not exercise at all (both gender and age groups) had significantly higher scores on the BDI-11 than the groups who exercised. A box plot depicting results for the inventory is included to show current effect and confidence intervals.

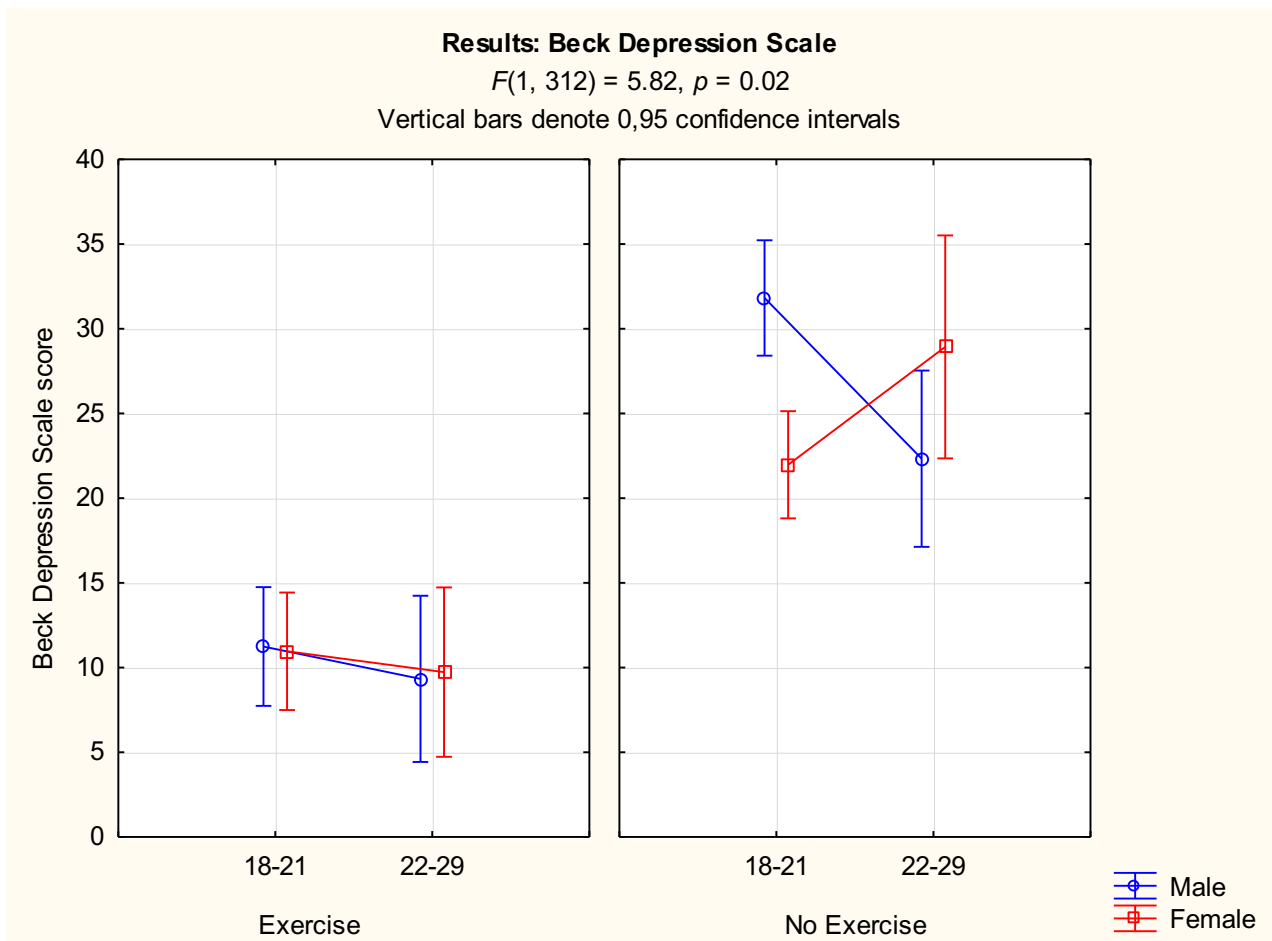


Figure 8: Box plot depicting MANOVA results for the BDI-11

5.4 Logistic Regression Results for the: Rosenberg Self-Esteem Scale (RSES), Becks Anxiety Inventory (BAI) and the Beck's Depression Inventory (BDI-11)

Logistic regression results for self-esteem, anxiety, and depression for the three scales/inventories used in this research are presented in the following table. The importance of running these statistics is to examine the existing relationships between independent variables using logistic regression analysis to predict the dependent data variables.

	Estimated Beta	p-value	Odds Ratio	95% Confidence Intervals	
Self-esteem					
<i>Gender</i>	-0.11	< 0.001**	0.89	0.86	0.93
<i>Age</i>	< 0.01	0.34	1.02	0.98	1.06
<i>Ethnicity</i>	0.06	0.32	1.06	0.94	1.20
<i>Exercise</i>	0.18	< 0.001**	1.20	1.14	1.27
Anxiety					
<i>Gender</i>	<0.01	0.95	1.00	0.98	1.02
<i>Age</i>	- 0.02	0.09	1.00	0.97	1.00
<i>Ethnicity</i>	-0.01	0.83	0.99	0.93	1.06
<i>Exercise</i>	- 0.09	< 0.001**	0.91	0.89	0.93
Depression					
<i>Gender</i>	0.01	0.09	1.01	1.00	1.03
<i>Age</i>	- 0.01	0.02*	0.98	0.96	1.00
<i>Ethnicity</i>	0.00	0.92	1.00	0.95	1.06
<i>Exercise</i>	- 0.09	< 0.001**	0.91	0.89	0.94

* $p < 0.05$, ** $p < 0.01$

Table 7: Logistic regression results for self-esteem, anxiety, and depression

The Odds Ratio (OR) is a measure of the strength of the association between a condition and an event. The OR takes values from zero to positive infinity. If it equals 1, it means that the condition and the event are not associated. If an odds ratio is greater than 1, the condition is more likely to occur in the first group, an odds ratio less than 1 indicates that the condition is less likely to occur in the first group. A 95% confidence interval is a range of values that a researcher can be certain contains the true means of the population.

5.4.1 The Rosenberg Self-Esteem Scale (RSES)

There was a significant effect of Gender. The OR was 1.89 (CI 0.86, 0.93) which means that the odds were that the second group (females) had a slightly lower (11%) chance of having a more positive self-esteem than their male counterparts. There was also a significant effect of Exercise Participation. The OR was 1.20 (CI 1.14, 1.27) which means that the odds were that the first group (participating in exercise) had a slightly higher (12%) chance of having more positive self-esteem than the second group (non-exercisers). No statistically significant results were noted for age ($p = 0.34$) and ethnicity ($p = 0.32$)

5.4.2 The Becks Anxiety Inventory (BAI)

There was a significant effect of Exercise Participation only. The OR was 0.91 (CI 0.89, 0.93) which means that the odds were that the second group (not participating in exercise) had a slightly higher (9%) chance of having more anxiety symptoms than the first group (exercisers). No statistically significant results were noted for gender ($p = 0.95$), age ($p = 0.09$) and ethnicity ($p = 0.83$).

5.4.3 The Beck's Depression Inventory (BDI-11)

There was a significant effect of Age. The OR was 0.98 (CI 0.96, 1.00) which means that the odds were that the second group (older participants) had a very slightly higher (2%) chance of having more symptoms of depression than the younger group. There was also a significant effect of Exercise Participation. The OR was 0.91 (CI 0.89, 0.94) which means that the odds were that the second group (not participating in exercise) had a slightly higher (9%) chance of having more symptoms of depression than the first group (exercisers). No statistically significant results were noted for gender ($p = 0.09$) and ethnicity ($p = 0.92$).

5.5 Summary

This chapter presented an analysis of the results of the study using descriptive and inferential statistics. Clarity was enhanced using tables and figures (graphical format) so that the entire picture of the data was clear. The following chapter (6) presents a discussion of the research findings. The research strengths, limitations and recommendations arising out of the study are also provided as well as the study conclusion.

CHAPTER 6

DISCUSSION OF RESEARCH FINDINGS, RESEARCH STRENGTHS AND LIMITATIONS, RECOMMENDATIONS AND CONCLUSION

6.1 Introduction

Chapter 6 presents a discussion of the research findings as related to the hypotheses and to appropriate literature and the theoretical underpinnings of the study namely the TTM. This theory is aimed at understanding individuals' behavioural changes and describing how people move dynamically through the different stages of behavioural change. It is widely used to describe and understand exercise behaviour, such as adoption and maintenance of exercise regimes (Han et al., 2017).

The research strengths, limitations and recommendations arising out of the study are also presented as well as an overall conclusion.

6.2 Discussion of study findings

The study findings are discussed in terms of the research hypotheses, appropriate literature, and the theoretical underpinning of the study the TTM. After this a proposed set of guidelines, for a student exercise regime, for undergraduates at UNIVEN is provided as no guidelines existed when the study was completed. These guidelines could be adapted for use at other institutions.

Hypothesis 1: Ho1: Students who exercise have more positive self-esteem than students who do not exercise

The MANOVA and logistic regression results support hypothesis 1. The MANOVA results revealed that the males who did not exercise at all had a significantly lower score on the RSES than the males who exercised ($p = 0.04$). Additionally, females who did not exercise at all scored lower on the RSES than the females who exercised. Surprisingly, there

were no significant differences in scores in females who did not exercise at all as compared to the females who exercised.

There was also a significant effect of Exercise Participation. The OR was 1.20 (CI 1.14, 1.27) which means that the odds were that the group who participated in exercise had a slightly higher (12%) chance of having more positive self-esteem than the non-exercise group. There were no other statistically significant results.

These findings are supported by Burke and Dempsey (2021) which indicated that exercise improves mental health by reducing anxiety, depression, and negative mood and by improving self-esteem and cognitive functions. Exercise has also been found to alleviate symptoms such as low self-esteem and social withdrawal. Additionally, research by Gilani and Feizabad (2019) revealed that having regular exercise increases the mean of self-esteem scores. This is in line with results from the present research which indicates that there is a positive relationship between exercise and increasing self-esteem. It was also reported that interventions such as doing mild to moderate physical exercise for four sessions a week, for nine months, had positive effects on the self-esteem of the depressed individuals.

The results of the present study are also underpinned to the stage in the TTM theory which is linked to self-efficacy. Self-efficacy is an individual's belief in their ability to organise and execute the course of action required to achieve specific goals, in this research it relates to individuals who exercise on a regular basis. Self-efficacy is important because individuals with high self-efficacy try harder to complete for instance, exercise tasks and as a result, are more likely to feel positive in terms of task completion (Kuan et al., 2019).

It is likely that respondents in this study who show low scores on self-esteem on the RSES and do not exercise are not yet ready to exercise. This is supported by the TTM stage of pre-contemplation which notes that individuals are not yet ready to perform specific tasks

(Al-Hussami et al., 2018; Prochaska & Velicer, 1997). In this research this is associated with respondents not being ready to exercise within the next 6 months. Sedentary individuals who are at this stage of the TTM are unaware of problems associated with obesity and lack of exercise. They are often labelled as resistant to, or not-motivated to change, by traditional exercise intervention programmes (Chamberlain et al., 2017; Prochaska & Velicer, 1997).

Ho2: Students who exercise have fewer depressive indicators than students who do not exercise

The MANOVA and logistic regression results of the study support this hypothesis. The MANOVA analysis indicated that the groups of students who did not exercise at all (both gender and age groups) had significantly higher scores on the BDI-11 (for depression) than the groups of students who exercised (both= $p < 0.02$).

The interaction of age revealed an OR of 0.98 (CI 0.96, 1.00) which means that older participants were more likely to have depressive symptomology than those in the younger group. The non-exercising group were also 9% more likely to have depressive symptomology than those who exercised although it was not statistically significant. No other statistically significant results were found.

The results of the present study are supported by research conducted by Adegoju and Abon (2021) who report that mental health issues are amongst the most predominant health challenges amongst students attending tertiary institutions. The authors stated that there are a high percentage of college students struggling to cope with psychological illnesses such as depression and anxiety. Furthermore, in this study it was concluded that students who engage in physical exercise showed positive mental health in terms of anxiety and depression than non-exercisers. It was also concluded that for both genders engaging in exercise contributed to the positive mental health outcomes.

These results can also be underpinned to the Action stage of the TTM. This is the stage in which individuals have made changes to their lifestyles during the past six months (Prochaska & Velicer, 1997). Respondents in this research who participated in exercise have taken action to improve their health and wellness. These respondents are also likely to underpin their lifestyle by Maintenance, which is the stage of the TTM when individuals have made alterations to their lifestyles and are working to avoid slipping back to their old behaviors (Alidosti et al., 2017).

The results of the present study indicate that respondents showing higher levels of depression on the BDI-11, due to not exercising, are in what the TTM describes as decisional balance. Decisional balance relates to the weighing of the positives and negatives (pros and cons) of, in this case doing exercise. Individuals often experience ambivalence about which course of action to take (Chamberlain et al., 2017) and are likely to go through several rotations of pre-contemplation, contemplation, and preparation before engaging in any action and they also may revert from one stage to an earlier stage (Prochaska & Velicer, 1997). This means that the non-exercise group of both male and female respondents were not able to execute the course of action required (do exercise) in order to have better physical and mental health.

Ho3: Students who exercise have less anxiety symptoms than students who do not exercise

The MANOVA and logistic regression results used in this study support this hypothesis. According to the MANOVA analysis the participants (both genders) who did not exercise at all had a significant higher score on the BAI (anxiety) than those who exercised (both $=p < 0.039$).

The results from the logistic regression analysis indicated that there was a significant effect of Exercise Participation. The OR was 0.91 (CI 0.89, 0.93) which means that the odds were that the group not participating in exercise had a slightly higher (9%) chance of having more anxiety symptoms than the group of exercisers. There were no other statistically significant results.

The results of the present are supported by research conducted by Brammer (2018), which reported that physical activity plays a role in stabilising and lessening feelings of anxiety as well as promoting positive overall well-being and mental health, irrespective of the persons' gender or age. Exercise is thus a strong measure for use in the treatment of anxiety and depression. The researcher reports that anxiety has been reduced significantly by a 20-minute exercise programme three times a week. Self-reported fears of anxiety, which include respiratory and cardiovascular symptomology decreased following a prescribed exercise intervention.

Another study that supports the results of the present study is research conducted by Rippe (2018) which noted that regular exercise has many psychological and emotional benefits that help individuals gain confidence. Meeting exercise goals or challenges, even small ones, can boost an individual's self-confidence. Furthermore, it helps people overcome social anxiety. Additionally, a study by Mandolesi et al. (2018) reported that individuals who exercise and do some physical activity have less likelihood of having anxiety and depression as opposed to those who are completely sedentary. In this study it was concluded that students who engage in physical exercise showed positive mental health in terms of anxiety and depression than non-exercisers. It was also concluded that for both genders engaging in exercise contributed to the positive mental health outcomes. Lun et al (2018) also found that students who exercised on a regular basis showed higher levels of self-confidence and overall

life-satisfaction in terms of social and academic progress. They also reported less depressive and anxiety symptomology.

The results of the present study can also be underpinned by the TTM stage of Preparation (Readiness). Preparation (Readiness) is the phase where individuals decide that they are going to act in the near or immediate future, typically measured as in the next month. These individuals usually have a strategy in terms of behaviour change such as going to gym, as they intend to exercise and have often discussed this behaviour change with their medical doctor (Alidosti et al., 2017). Furthermore, results of this research indicate that respondents showing higher levels of anxiety on the BAI, due to not exercising can be associated with pre-contemplation in the TTM. This is characterised, in this research, by having no intentions of exercising within the next six months (Al-Hussami et al., 2018). It can be inferred that this group of respondents do not realise the importance of using exercise as an intervention to enhance their overall well-being and mental health.

6.3 Guidelines for exercise for undergraduate students at the University of Venda (UNIVEN)

The study results supported findings in international and South African research which found that exercise helps in terms of students being less anxious, having more self-esteem and being less depressed. As a result of these findings the development of basic guidelines for exercise of undergraduate students at UNIVEN were developed underpinned by the TTM. Guidelines for exercise developed out of a theoretical model in South Africa are unique to this research.

However, here are important considerations when developing guidelines for physical exercise amongst students, these were addressed in 3.12.8. In understanding the limitations in

this regard, the following exercise guidelines for undergraduate students at UNIVEN were developed. It must also be noted that physical activity is different to physical exercise. According to the Society of Health and Physical Educators (SHAPE, 2021) in America exercise programmes provide learning opportunities (in specific types of sport or exercise regimes). In physical exercise there is proper instruction or coaching so that people can learn the appropriate rules, activities, etcetera in a specific exercise activity. They note physical activity can be any activity for instance, gardening or other recreational activity which involves some physical exertion.

The University of Venda (UNIVEN) should first have a policy pertaining to physical exercise amongst its undergraduate students. This should consider for instance, if the student is physically challenged in anyway and/or pregnant or has a chronic illness. Policy and guidelines for these groups, as opposed to students who are not physically challenged or pregnant, might differ slightly. The policy should consider how many times and/or hours per week the student should exercise. These guidelines should not be mandatory as a tertiary institution is not mandated to ensure physical fitness and exercise even though this helps with overall wellness for instance, psychological well-being and the alleviation of anxiety and depression. Students should be educated during orientation and follow up seminars/webinars should take place on the importance of physical fitness and exercise for health and well-being. The formulation of an exercise policy for undergraduates could contemplate the following which have been adapted from Ballard et.al. (2005).

1. Undergraduate students should be encouraged to take part in 130 – 150 minutes of moderate-intensity physical exercise per week which should include a mixture of muscle strengthening, flexibility exercise and aerobic activity. As the individual becomes fitter this could rise to 300 minutes or more per week.

2. If the undergraduate is physically challenged or pregnant their needs should be considered for instance, pregnant women can do 150 minutes of exercise a week however, during their last trimester physical activity may be more appropriate. Physically challenged students or those living with disorders such as diabetes can do 150 and up to 300 minutes of exercise per week depending on their overall health. This group must always get a medical doctor's opinion before exercising at all.
3. This activity should not occur when their academic programme is in progress.
4. Sports offerings should be properly communicated to undergraduate students during orientation and with follow up seminars/workshops and or webinars.
5. All physical exercise such as various sporting activities and exercise regimes such as aerobics, muscle strengthening, and flexibility exercises should be taught by an accredited sports coach, Biokineticist, Sport Science or Human Movement, Kinetics and Ergonomic graduate. These should be employed by the institution for team sport and individualised sporting programmes. These professionals must continually update their expertise and belong to appropriate professional bodies. For instance, a Biokineticist belongs to a specific area in the Health Professions Council of South Africa (HPCSA) and has to have continuing professional development (CPD) points in order to remain registered.
6. The institution should have a fully equipped gymnasium with a specialised aerobic floor (to help prevent injury). Sports fields/courts/swimming pools should be kept in good condition.

7. The physical exercise professions must be able to assess the overall fitness of an individual (or group) of students before they commence any exercise regime or sporting activity.
8. A policy should include a section on the benefits of regular physical exercise.

6.3.1 Guidelines for physical activity amongst undergraduate students at UNIVEN underpinned by the TTM

These guidelines are not inclusive and can be adapted, added to, or changed as the institution sees fit. This should happen with the input of exercise professionals who should be involved in refining the guidelines and/or conducting the exercise and/or sports programmes. They are underpinned by the TTM and integrate into the findings of the research which indicate that depression and anxiety symptomology are alleviated through exercise.

1. A pull down menu on the UNIVEN website pertaining to the benefits of participating in sport and exercise regimes should be provided. This could be a pull-down menu including Healthy Eating, Exercise Participation and Psychological Well-being as well as various relaxation techniques that could be used in combination with the aforementioned. This is linked to the pre-contemplation phase as first year students who have not considered any exercise and are sedentary are likely to look at the website if guided to do so through the orientation process. For instance, during first year information sessions students are shown the menu and encouraged to access it for themselves. They may enter the contemplation stage of the TTM and recognise that they are sedentary, possibly have poor-eating habits and need to reduce their stress and anxiety which they have been informed during orientation week, is helped by an exercise regime. Students enter a phase of decisional balance which looks at the positives and negatives in their undertaking an exercise regime. For this, they may well consult the pull-down menu and/or sports officers at the institution.

2. Undergraduate students should participate in at least 130 minutes of exercise either through sports participation or specific exercise programmes (if medically appropriate). After decisional balance students may want to change their sedentary lifestyles and start to exercise. They will prepare by looking at recommended exercise regimes. They may consult the pull-down menu, other internet sites, sports officers and/or peers who exercise regularly. This means they will start to strategise their behaviour change in terms of exercise regimes that they feel comfortable with. They will then take action that is, actually ‘doing’ the exercise regime they have decided on.

3. The overall benefit to student health and well-being and ultimately academic success, in being involved in physical exercise should be explained on the pull-down menu on the UNIVEN website, using appropriate graphics and pamphlets that can be downloaded. In terms of the TTM, this leads them to maintain their exercise regime as they have realised its overall benefit to their health both physical and psychologically. However, they may relapse and stop their exercise regime at any point. As they now have information about exercise and its general benefits to their overall wellness it is likely that they will start the process again. It can take several cycles of action and relapse before an individual maintains their exercise programme.

4. Basic exercise programmes and routines should be provided on the UNIVEN website for all levels and kinds of exercises. Information on how to get more help from an appropriate professional (employed by UNIVEN) should be on the website particularly if the student has a disorder of any kind, is physically challenged or pregnant (An example of an exercise programme for beginners is provided in Figure 9). Information on the pull-down menu about how exercise helps prevent depression and anxiety and builds self-confidence in individuals should be provided. An explanation of the TTM as a health behaviour change theory should be provided so that students can understand the cyclical process of any

behaviour change, in this case related to exercise and its benefits. This will help them understand the possibility of relapse and how behaviour change can be cyclical in nature.

	MON	TUE	WED	THU	FRI	SAT	SUN
WEEK 1	25-30 min Cardio	Core Workout	Upper Body Workout	25-30 min Cardio	Total Body Workout	25-30 min Cardio	REST
WEEK 2	30 min Cardio	Core Workout	Upper Body Workout	30 min Cardio	Total Body Workout	30 min Cardio	REST
WEEK 3	35-40 min Cardio	Core Workout	Upper Body Workout	35-40 min Cardio	Total Body Workout	35-40 min Cardio	REST
WEEK 4	40 min Cardio	Core Workout	Upper Body Workout	40 min Cardio	Total Body Workout	40 min Cardio	REST

Figure 9: Example of physical exercise beginner workout guide (throughtheburn.com)

It is hoped these basic guidelines and suggestions will be of use to UNIVEN in considering making exercise and sport important parts of their student offerings in order to enhance the physical and mental health and overall well-being of students.

6.4 Research strengths, limitations, and recommendations

The research strengths, limitations, and recommendations arising out of the research process are provided.

6.4.1 Research strengths

Firstly, the research used random sampling which means that results can be generalised, and bias was controlled.

Secondly, the research design was appropriate for the study and can be replicated.

Thirdly, the study used appropriate methods of analysis and the theoretical underpinning of the study was appropriate in supporting the research results.

Lastly and importantly, the current study generated prospective exercise guidelines for UNIVEN students specifically, and university students in South Africa generally. This is a gap which the present research identified in terms of student exercise at tertiary institutions.

6.4.2 Research limitations

Limitations are expected in all studies, the first limitation of this study was that the study was conducted at one university, there might be different results if conducted at other institutions.

The second limitation of this study is that it was limited to an institution in a rural area which could mean that results for instance, in an urban context may be different. Fundamentally, it can be argued that the results of the study should be interpreted within the context of where it was conducted, even though the sample was randomised.

The third limitation of this study is that the study only used a quantitative approach there was no triangulation with a qualitative method. Based on knowledge gathered, it may well have been more useful if for instance, students had been asked why they did or did not exercise. This would have allowed for a more holistic understanding of the phenomenon.

The fourth limitation of this study is that the sample was mostly African (95%), with 1% White respondents, 2% Coloured respondents and 2% Indian respondents. However, it can be argued that most people in the country are African thus the limitation is embedded within this context.

The fifth limitation is, that although a HKE graduate was used to look at the guidelines in terms of appropriateness it may well have been more beneficial to have an external supervisor at another institution who had specialised knowledge in the field. None was available at the University of Limpopo however, Professor Nel (External Supervisor)

does research into the field of Sport in terms of psychological issues and has also been an assessor for Sports Science and HKE masters and doctoral theses.

In retrospect, another limitation is that self-efficacy of the sample was not explored future research should include this variable.

6.4.3 Research recommendations

Taking into consideration the overall results of the current study, the following recommendations are made. First, future studies should consider using multiple research methods or triangulation. This will broaden the scope, and possible outcomes, of the research.

Secondly, a more comprehensive study with more universities is recommended. This will open more gaps and increase knowledge in the study of the occurrence of mental health issues and exercise in difference environments, ascertaining whether individuals in learning institutions that are in rural areas are exposed to the same rate of mental illness and access to exercise facilities as compared to the ones in cities or urban areas.

Thirdly, a study that includes equal size of groups and ethnicity balance is recommended to see if results differ.

The last and important recommendation is that tertiary institutions implement exercise programmes and promote them for use amongst undergraduate students. Students should be made aware of how exercise mediates against depression and anxiety, helps improve self-esteem and helps them gain better overall physical and psychological well-being.

Results of the study will be made to appropriate university bodies and the Department of Education (DoE) which, it is hoped will encourage the promotion of regular workshops on the benefits of exercise and well-being at the University of Venda (UNIVEN).

6.5 Reflections on the research process

I found undertaking this study very insightful and informative as it gave me insight in viewing mental health matters relating to exercise in first year undergraduate students. As a Clinical psychologist working with mental health issues and understanding the complexities and impact that this type of research has on an individual's biopsychosocial functioning, has made me aware that exercise can improve mental health problems. However, it seems that lack of knowledge about the benefits of exercise is limited in the institution in which I carried out the study.

As a Venda person knowing and understanding that I came from a community that is ill resourced and ill-informed about mental health is very concerning. I feel that the study has helped me in terms of trying to provide initiatives, in this case, guidelines for undergraduate exercise, to inform university management about this lack.

I also realised that I have matured as a researcher, knowing that this study will make some impact in terms of the results and exercise guidelines generated. Lastly, I would also like to acknowledge my external supervisor Prof Nel who has much knowledge about sport and exercise, and who has been a constant support. This is also true of my internal supervisor Prof Govender. Thank you, professors, for your expertise, guidance, and support not only to myself but all the students you supervise and help.

6.6 Overall study conclusion

The aim of the study was to investigate the impact of exercise on depression, anxiety, and self-esteem on first-year students registered at the UNIVEN located in the Vhembe district of Limpopo, which it has done.

Generally, the findings of this study support literature and supported many results found in previous research, both local and international, regarding the association between

exercise, depression, anxiety and/or self-esteem. The hypotheses of this study were also fully supported by the results and were explained by the theoretical framework of the research namely, the Trans Theoretical Model (TTM).

Results pertaining to age and gender in this study unexpectedly revealed that there were no significant differences in scores in females who exercised not at all as compared to the females who exercised regularly. In most cases there were no statistically significant results noted for gender age and ethnicity

Overall, the current study contributes, in a significant manner, to understanding the impact exercise plays as an intervention in mental health challenges that may occur because of adjustment difficulties and academic demands placed on first year students attending tertiary institutions. The guidelines and knowledge provided by this study will help the Department of Education (DoE) in the province and nationally as well as UNIVEN and tertiary institutions generally, in providing exercise interventions to the tertiary education sector.

Lastly, the current study identified a gap in this field of research in the country. It is the first study to generate guidelines for exercise in undergraduate students at any South African tertiary institution.

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APPENDIX 1: QUESTIONNAIRE

SECTION A: DEMOGRAPHIC INFORMATION

Instructions: Please tick where appropriate (or write the answer). NB: Only first entering (first year) students should complete the form.

1. Gender

Male	
Female	

2. Age

18-21	
22-29	
Other – please write in the block	

3. Race

Black	
White	
Coloured	
Indian/Asian	

4. Do you exercise regularly or are you involved in any sport/exercise that you participate in? *Please tick one box.*

Not at all

Regularly (twice or three times a week)

Every week day

5. If your previous response was *regularly or every weekday* which type of exercise/sport activity, do you do?

Please specify

SECTION B: ROSENBERG SELF-ESTEEM SCALE (RSES)

This section contains the list of statements dealing with your general feelings. Mark with a cross(X)

Key: SA- Strongly Agree; A-Agree; D- Disagree; SD- Strongly Disagree

1. On the whole, I am satisfied with myself.	SA 4	A 3	D 2	SD 1
2. At times I feel like I am not good at all.	4	3	2	1
3. I feel that I have a number of good qualities.	4	3	2	1
4. I am able to do things as well as most other people.	4	3	2	1
5. I feel I do not have much to be proud of	4	3	2	1
6. I certainly feel useless at times	4	3	2	1
7. I feel that I'm a person of worth, at least on an equal plane with others.	4	3	2	1
8. I wish I could have more respect for myself.	4	3	2	1
9. All in all, I am inclined to feel that I am a failure.	4	3	2	1
10. I take a positive attitude towards myself.	4	3	2	1

SECTION C: BECKS' DEPRESSION INVENTORY-11 (BDI-11)

Instructions

This questionnaire consists of 21 groups of statements. **Please** read each group of statements carefully, and then pick out the **one statement** in each group that best describes the way you have been feeling during the **past two weeks, including today**.

Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (change in sleep pattern) or Item 18 (change in appetite).

1. Sadness

- 0 I do not feel sad.
- 1 I feel sad much of the time.
- 2 I am sad all the time.
- 3 I am so sad or unhappy that I can't stand it.

2. Pessimism

- 0 I am not discouraged about my future.
- 1 I feel more discouraged about my future than I used to be.
- 2 I do not expect things to work out for me.
- 3 I feel my future is hopeless and will only get worse.

3. Past Failure

- 0 I do not feel like a failure.
- 1 I have failed more than I should have.
- 2 As I look back, I see a lot of failures.
- 3 I feel I am a total failure as a person.

4. Loss of Pleasure

- 0 I get as much pleasure as I ever did from the things I enjoy.
- 1 I don't enjoy things as much as I used to.
- 2 I get very little pleasure from the things I used to enjoy.
- 3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings

- 0 I don't feel particularly guilty.
- 1 I feel guilty over many things I have done or should have done.
- 2 I feel quite guilty most of the time.
- 3 I feel guilty all of the time.

6. Punishment Feelings

- 0 I don't feel I am being punished.
- 1 I feel I may be punished.
- 2 I expect to be punished.
- 3 I feel I am being punished.

7. Self-Dislike

- 0 I feel the same about myself as ever.
- 1 I have lost confidence in myself.
- 2 I am disappointed in myself.
- 3 I dislike myself.

8. Self-Criticalness

- 0 I don't criticize or blame myself more than usual.
- 1 I am more critical of myself than I used to be.
- 2 I criticize myself for all of my faults.
- 3 I blame myself for everything bad that happens.

9. Suicidal Thoughts or Wishes

- 0 I don't have any thoughts of killing myself.
- 1 I have thoughts of killing myself, but I would not carry them out.
- 2 I would like to kill myself.
- 3 I would kill myself if I had the chance.

10. Crying

- 0 I don't cry anymore than I used to.
- 1 I cry more than I used to.
- 2 I cry over every little thing.
- 3 I feel like crying, but I can't.

11. Agitation

- 0 I am no more restless or wound up than usual.
- 1 I feel more restless or wound up than usual.
- 2 I am so restless or agitated that it's hard to stay still.
- 3 I am so restless or agitated that I have to keep moving or doing something.

12. Loss of Interest

- 0 I have not lost interest in other people or activities.
- 1 I am less interested in other people or things than before.
- 2 I have lost most of my interest in other people or things.
- 3 It's hard to get interested in anything.

13. Indecisiveness

- 0 I make decisions about as well as ever.
- 1 I find it more difficult to make decisions than usual.
- 2 I have much greater difficulty in making decisions than I used to.
- 3 I have trouble making any decisions.

14. Worthlessness

- 0 I do not feel I am worthless.
- 1 I don't consider myself as worthwhile and useful as I used to.
- 2 I feel more worthless as compared to other people.
- 3 I feel utterly worthless.

15. Loss of Energy

- 0 I have as much energy as ever.
- 1 I have less energy than I used to have.
- 2 I don't have enough energy to do very much.
- 3 I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

- 0 I have not experienced any change in my sleeping pattern.

- 1a I sleep somewhat more than usual.
- 1b I sleep somewhat less than usual.

- 2a I sleep a lot more than usual.
- 2b I sleep a lot less than usual.

- 3a I sleep most of the day.
- 3b I wake up 1-2 hours early and can't get back to sleep.

17. Irritability

- 0 I am no more irritable than usual.
- 1 I am more irritable than usual.
- 2 I am much more irritable than usual.
- 3 I am irritable all the time.

18. Changes in Appetite

- 0 I have not experienced any change in my appetite.

- 1a My appetite is somewhat less than usual.
- 1b My appetite is somewhat greater than usual.

- 2a My appetite is much less than before.
- 2b My appetite is much greater than usual.

- 3a I have no appetite at all.
- 3b I crave food all the time.

19. Concentration Difficulty

- 0 I can concentrate as well as ever.
- 1 I can't concentrate as well as usual.
- 2 It's hard to keep my mind on anything for very long.
- 3 I find I can't concentrate on anything.

20. Tiredness or Fatigue

- 0 I am no more tired or fatigued than usual.
- 1 I get more tired or fatigued more easily than usual.
- 2 I am too tired or fatigued to do a lot of the things I used to do.
- 3 I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

- 0 I have not noticed any recent change in my interest in sex.
- 1 I am less interested in sex than I used to be.
- 2 I am much less interested in sex now.
- 3 I have lost interest in sex completely.

SECTION D: BECKS ANXIETY INVENTORY (BAI)

Tick the block that represents how you feel right now (only tick one block)

	Not at All	Mildly but it didn't bother me much	Moderately – it wasn't pleasant at times	Severely – it bothered me a lot
Numbness or tingling				
Feeling hot				
Wobbliness in legs				
Unable to relax				
Fear of worst happening				
Dizzy or lightheaded				
Heart pounding/racing				
Unsteady				
Terrified or afraid				
Nervous				
Feeling of choking				
Hands trembling				
Shaky / unsteady				

Fear of losing control				
Difficulty in breathing				
Fear of dying				
Scared				
Indigestion				
Faint / lightheaded				
Face flushed				
Hot/cold sweats				

Scoring of the Becks Anxiety Inventory

Score of 0-21 = low anxiety

Score of 22-35 = moderate anxiety

Score of 36 and above = potentially concerning levels of anxiety.

APPENDIX 2: Jacobson's (1934) relaxation technique

Progressive Muscle Relaxation (PMR) is a relaxation technique that requires an individual to focus on flexing and holding a certain set of muscles and then slowly relaxing those same muscles. As the individual flexes and releases those muscles from top to bottom they will feel a deep sense of relaxation. Progressive Muscle Relaxation is an adapted version of the Jacobson's Relaxation Technique developed in the 1930's. An individual has to allow him or herself 15–20 minutes to complete this relaxation technique. They must find a place that is warm, quiet, and free from disturbances. If possible, dim the lights and tell people that you should not be disturbed – you may want to switch off any phones. Make yourself comfortable on the floor, on the bed or in a chair. Snuggle down and settle your body so that it feels limp.

What a person needs to do is as follows

- Gently breathe in – hold – and let go.
- Gently pull your toes up towards your knees – just a little – hold briefly – and let go.

Recognise the difference.

- Press your heels into the floor – hold – and let go.
- Pull your knees together – hold briefly – now let them drift apart a little. Be aware of the new position.
- Squeeze your buttocks together – hold – now let go.
- Gently pull in your tummy muscles towards your spine – hold briefly – now let go. Feel the difference.
- Shoulders – gently pull them up towards your ears, just enough to recognise the tension – hold briefly – now let go. Recognise the new position.
- Gently press your elbows and upper arms to the sides of your body – hold for a moment – now let go.
- Hands – gently clench – hold – and let go.

- Push your head forward slightly – hold briefly – now let your head go back to a balanced position. Feel the difference.
- Grit your teeth together – hold briefly – now let your jaw sag slightly. Feel the difference.
- Lips – press together – now let go until hardly touching. Purse your lips – now let go and feel the difference.
- Press your tongue briefly to the roof of your mouth – hold – and let it drop loosely. Feel the new position.
- Eyes – screw them up a little – hold – and let go.
- Forehead – frown a little – hold – now let go.

APPENDIX 3 TURFLOOP RESEARCH ETHICS COMMITTEE FORMS

FORM B – PART I

PROJECT TITLE: The Impact of Exercise on Self-esteem, Anxiety, and Depression on First-year Students at the University of Venda.

PROJECT LEADER: K L Tshikovhele

DECLARATION

I, the signatory, hereby apply for approval to conduct research described in the attached research proposal and declare that:

1. I am fully aware of the guidelines and regulations for ethical research and that I will abide by these guidelines and regulations as set out in documents (available from the Secretary of the Ethics Committee); and

2. I undertake to provide every person who participates in this research project with the relevant information in Part III. Every participant will be requested to sign Part IV.

Name of Researcher: K L Tshikovhele

Signature:.....

Date:.....

For Official use by the Ethics Committee:

Approved/Not approved

Remarks:.....

.....
.....

Signature of Chairperson:.....

Date:.....

FORM B - PART II

PROJECT TITLE: The Impact of Exercise on Self-esteem, Anxiety, and Depression on First-year Students at the University of Venda.

PROJECT LEADER: Mr. K L Tshikovhele

Protocol for conducting research using human participants

1. Department: Psychology
2. Title of project: The Impact of Exercise on Self-esteem, Anxiety, and Depression on First-year Students at the University of Venda.
3. Full name, surname and qualifications of project leader: Mr. K L Tshikovhele: MA in Clinical Psychology (UL).
4. List the name(s) of all persons (Researchers and Technical Staff) involved with the project and identify their role(s) in the conduct of the experiment:

Name: Qualifications:

KL Tshikovhele MA in Clinical Psychology

Responsible for: All the research

5. Name and address of principal researcher: Mr. K L Tshikovhele
6. Procedures to be followed: as noted in the proposal. Participants will also be told that they may withdraw from the research at any time.
7. Nature of discomfort: Participants may be anxious and feel traumatised by answering questions in the Focus Group. Any participant who feels this way will be referred to a counsellor/psychologist at the University who has agreed to counsel these participants.

8. Description of the advantages that may be expected from the results of the study: The findings of the current study will help to broaden research on the impact of exercise on depression, anxiety and self-esteem amongst student populations, particularly those who are previously disadvantaged. Furthermore, the recommendations that arise out of the current study will help to guide future interventions in terms of enhancing student health and mental well-being at the University of Venda.

Signature of Project Leader:.....

Date:.....

PART III

INFORMATION FOR PARTICIPANTS

PROJECT TITLE: The Impact of Exercise on Self-esteem, Anxiety, and Depression on First-year Students at the University of Venda.

PROJECT LEADER: Mr. K L Tshikovhele

1. You are invited to participate in the following research project: (see consent form below)
2. Participation in the project is completely voluntary and you are free to withdraw from the project (without providing any reasons) at any time.
3. It is possible that you might not personally experience any advantages during the project, although the knowledge that may be accumulated through the project might prove advantageous to others.
4. You are encouraged to ask any questions that you might have in connection with this project at any stage. The project leader and her/his staff will gladly answer your question. They will also discuss the project in detail with you.
5. Participants may be anxious and feel traumatised by filling in the questionnaires. Any participant who feels this way will be referred to the correctional services psychologist/counsellor.
6. Should you at any stage feel unhappy, uncomfortable or is concerned about the research, please contact **Ms Noko Shai-Ragoboya at the University of Limpopo, Private Bag X1106, Sovenga, 0727, tel: 015 268 2401.**

PART IV

CONSENT FORM

PROJECT TITLE: The Impact of Exercise on Self-esteem, Anxiety, and Depression on First-year Students at the University of Venda.

PROJECT LEADER: Mr K L Tshikovhele

I, _____

hereby voluntarily consent to participate in the following project: **The Impact of Exercise on Self-esteem, Anxiety, and Depression on First-year Students at the University of Venda.**

I realise that:

1. The study deals with my experiences both academic and social in terms of any challenges I might face as a registered student at the University of Limpopo (Turfloop Campus).
2. The procedure or treatment envisaged may hold some risk for me that cannot be foreseen at this stage.
3. The Ethics Committee has approved that individuals may be approached to participate in the study.
4. The research project, ie. the extent, aims and methods of the research, has been explained to me.
5. The project sets out the risks that can be reasonably expected as well as possible discomfort for persons participating in the research, an explanation of the anticipated advantages for myself or others that are reasonably expected from the research and alternative procedures that may be to my advantage.

6. I will be informed of any new information that may become available during the research that may influence my willingness to continue my participation.
7. Access to the records that pertain to my participation in the study will be restricted to persons directly involved in the research.
8. Any questions that I may have regarding the research, or related matters, will be answered by the researcher/s.
9. If I have any questions about, or problems regarding the study, or experience any undesirable effects, I may contact a member of the research team or Ms Noko Shai-Ragoboya.
10. Participation in this research is voluntary and I can withdraw my participation at any stage.
11. If any medical problem is identified at any stage during the research, or when I am vetted for participation, such condition will be discussed with me in confidence by a qualified person and/or I will be referred to my doctor.
12. I indemnify the University of Limpopo and all persons involved with the above project from any liability that may arise from my participation in the above project or that may be related to it, for whatever reasons, including negligence on the part of the mentioned persons.

SIGNATURE OF RESEARCHED PERSON _____

SIGNATURE OF WITNESS _____

SIGNATURE OF PERSON THAT INFORMED _____

SIGNATURE OF PARENT/GUARDIAN _____

THE RESEARCHED PERSON _____

Signed at _____ this ____ day of _____ 20__

APPENDIX 4: ETHICAL CLEARANCE CERTIFICATE



University of Limpopo
Department of Research Administration and Development
Private Bag X1106, Sovenga, 0727, South Africa
Tel: (015) 268 3935, Fax: (015) 268 2306, Email: anastasia.ngobe@ul.ac.za

TURFLOOP RESEARCH ETHICS COMMITTEE
ETHICS CLEARANCE CERTIFICATE

MEETING: 02 October 2019

PROJECT NUMBER: TREC/349/2019: PG

PROJECT:

Title: The impact of exercise on self-esteem, anxiety, and depression on first-year students at the University of Venda.
Researcher: KL Tshikovhele
Supervisor: Prof S Govender
Co-Supervisor/s: Prof K Nel
School: Social Science
Degree: PhD in Clinical Psychology


PROF P MASOKO
CHAIRPERSON: TURFLOOP RESEARCH ETHICS COMMITTEE

The Turfloop Research Ethics Committee (TREC) is registered with the National Health Research Ethics Council, Registration Number: REC-0310111-031

Note:

- i) This Ethics Clearance Certificate will be valid for one (1) year, as from the abovementioned date. Application for annual renewal (or annual review) need to be received by TREC one month before lapse of this period.
- ii) Should any departure be contemplated from the research procedure as approved, the researcher(s) must re-submit the protocol to the committee, together with the Application for Amendment form.
- iii) PLEASE QUOTE THE PROTOCOL NUMBER IN ALL ENQUIRIES.

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APPENDIX 5: PERMISSION TO CONDUCT RESEARCH AT THE UNIVERSITY OF VENDA

Research and Innovation
Office of the Director

Date: 05 November 2019

Mr KL Tshikovhele
University of Limpopo
Department of Psychology
Faculty of Humanities
Sovenga
0727

Dear Mr KL Tshikovhele

Permission to conduct Research at the University of Venda


You are hereby granted permission to conduct research at the University of Venda.

The research will be based on your Doctoral Research titled: *The impact of exercise on self-esteem, anxiety, and depression on first-year students at the University of Venda* registered at the University of Limpopo.

The conditions are that all the data pertaining to University of Venda will be treated in accordance with the Ethical Principles and that will be shared with the University. In addition, consent should be sought by you as a researcher from participants.

Attached is our policy on ethics.

Thank you


Senior Prof. G.E. Ekosse
Director Research and Innovation

Cc: Prof JE Crafford (DVC Academic)



UNIVERSITY OF VENDA
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APPENDIX 6 – LETTER FROM THE EDITOR

To Whom It May Concern I declare that I, K. Louise Nel, have proof-read and edited the PHD entitled: **The impact of exercise on self-esteem, anxiety, and depression on first year students at the University of Venda. Author: Khodani Lucky Tshikovhele**

The PHD was generally well written. Major grammatical errors were found and corrected. I corrected many references as the student used APA-6 not APA-7. The layout in the text is mostly APA-7 however, some elements were not according to APA-7 format. I did not correct all of these as the student must take responsibility for this.

I have been editing journal articles, dissertations, and theses for a period of five years.

K Louise Nel

Ms K Louise Nel HKE (Rhodes): Hons HKE (Rhodes)

Private Tutor and Assistant Teacher

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