Evaluating a mindfulness intervention for improving sleep, mental health and academic performance in university students

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DECLARATION

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ABBREVIATIONS

AAQ-II	Acceptance and Action Questionnaire-II
AUDIT-C	Alcohol Use Disorders Identification Test Consumption
BDI	Beck Depression Inventory
CAMM	Child and Adolescent Mindfulness Measure
CAMS-R	Cognitive and Affective Mindfulness Revised
CBCL	Child Behaviour Checklist
CFS	Chronic Fatigue Syndrome
DASS-21	Abbreviated Depression, Anxiety and Stress scale
DSA	Department of Student Affairs
FFMQ	Five Facet Mindfulness Questionnaire
GAD	Generalized Anxiety Disorder
GMT	Group Mindfulness Therapy
MAAS	Mindful Attention Awareness Scale
MAC	Mindfulness Acceptance Commitment
MAP	Mindfulness awareness practices
MBCT	Mindfulness Based Cognitive Therapy
MBI	Mindfulness Based Intervention
MBSR	Mindfulness Based Stress Reduction
MBT- I	Mindfulness Based Therapy
MM	Mindfulness Meditation
MOS	Medical Outcome Study
MPA	Musical Performance Anxiety
MRI	Magnetic Resonance Imaging

NF	Nuclear Factor
Non-REM	Non-Rapid Eye Movement
PANAS	The Positive and Negative Affect Schedule
PC-PTSD	The Primary Care PTSD
PHQ-9	Patient Health Questionnaire-9
PRISMA	Preferred Reporting Items for Systematic Reviews and Meta-Analysis
PSS	Perceived Stress Scale
PSWQ	Penn State Worry Questionnaire
PSQI	Pittsburgh Sleep Quality Index
PTSD	Post-traumatic stress disorder
REM	Rapid Eye Movement
SADAG	South African Depression and Anxiety Group
SCARED	Screen for Child Anxiety Related Disorders
SMFQ	Short Mood and Feelings Questionnaire
SRPP	Students' research participation program
STAI	State & Trait Anxiety Index
STICSA	State-Trait Inventory for Cognitive and Somatic Anxiety
SPWB	Subjective Psychological Wellbeing

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ABSTRACT

Mental health difficulties, including depression and anxiety, are one of the biggest challenges that university students face. These difficulties have an impact on other aspects of functioning such as sleep quality and quantity. However, studies show a bidirectional relationship between sleep and mental health challenges, hence continous poor sleep may lead to increased symptoms of anxiety and depression. Additionally, poor sleep and mental health challenges faced by students results in poor academic perfomance. Mindfulness has been recognised as an accessable treatment used to improve sleep, thereby reducing mental health problem and improve academic perfomance. The objective of this study was to evaluate mindfulness as an intervention for poor sleep, and subsequent mental health challenges and academic performance in university students. Participants were divided into two groups, an intervention group (n = 20) that received mindfulness training and a control group (n = 18) that did not. The treatment intervention consisted of a daily 20- minute audio-guided exercise which was completed over a 7-day period. I measured sleep quality, depressive and anxiety-related symptoms, and academic performance before and after the intervention/control period. Results showed no improvement in sleep quality, anxiety-related symptoms or academic performance between the intervention and control groups. However, there was a decrease in depressive symptoms in participants who completed the mindfulness intervention. These findings highlight the positive influence of mindfulness on depressive symptoms in university students. However, future studies should further investigate the associations between mindfulness, sleep quality and mental health outcomes in students, who are vulnerable to a high burden of mental health difficulties.

Keywords: Mental Health, Poor Sleep, Mindfulness Intervention

CHAPTER 1

INTRODUCTION

For many young adults there is the perception that stepping into tertiary education allows independence from parental control together with personal and career growth. However, university students face many potential stressors including but not limited to academic pressure, transitioning to adulthood, relationships problems and exposure to substances (Auerbach et al., 2018; Bantjes et al., 2016; Brougham, et al., 2009; Cruwys, Greenway, & Haslam, 2015; Gaultney, 2010; Stallman & Hurst, 2016; Tsui & Wing, 2009). These stressors have a negative impact on sleep and mental health (Bantjes et al., 2016). Although there is a well-known bidirectional relationship between sleep and mental health, the focus of this study is on sleep's influence on mental health (Jin Li, Zhou, Li, & Wang, 2016). One way to target sleep disruption is through mindfulness. Therefore, this study aims to use mindfulness to improve sleep quality and see whether there are any associated improvements in mental health (depression and anxiety symptoms) and academic performance (American Psychological Association, 2013; Bantjes et al., 2016; Hayley, Sivertsen, Hysing, Vedaa, Øverland, 2017; Jin Li, Zhou, Li, & Wang, 2016; Stallman & Hurst, 2016; Simor, Krietsch, Köteles, & Mccrae, 2015).

Mental Health Challenges Experienced by University Students

Mental health problems can be described as a behavioural, physiological, and emotional response to a stimulus that is regarded as threat or a demand (Segal, Smith, Segal, & Robinson., 2017). One could argue that mental health issues are the biggest problems faced globally by university students (Nguyen-Feng, Greer & Frazier, 2017). Students face mental health challenges which include substance use, suicidality, stress, anxiety and depression (Auerbach et al., 2018). For example, research conducted in 26 universities across the United States showed that 4.1% of students suffered from panic disorder, 6.3% had suicidal

ideations, 7% suffered from generalized anxiety and 17% suffered from depression (Nguyen-Feng, Greer & Frazier, 2017). In South Africa however, there seems to be very minimal research on the prevalence of mental health problems among university students **(**Bantjes et al., 2016). One study conducted by Bantjes et al. (2016) suggests in South African universities, about 12% of students suffered from depression, while 15% were found to suffer from severe anxiety and 24% suffer from suicidal ideations. Although this study was not only focused on depression and anxiety, however it did highlight these disorders as a major concern among university students. There maybe many contributors to depression and anxiety in university students, key amongst these is disrupted sleep (Stallman & Hurst, 2016).

Sleep Quality and Quantity Experienced by Students

Mental health challenges experienced by university students contribute to poor quantity and quality of sleep (Jin Li, Zhou, Li, & Wang, 2016). However, studies show a bidirectional relationship between sleep and mental health challenges. Hence, poor sleep may contribute to the development and maintenance of mental health difficulties such as depression and anxiety (American Psychological Association, 2013; Bantjes et al., 2016; Hayley, Sivertsen, et al., 2017; Jin Li, Zhou, Li, & Wang, 2016; Stallman & Hurst, 2016; Simor, Krietsch, Köteles, & Mccrae, 2015). Poor sleep may affect student's psychological status and daily experiences (Jin Li, Zhou, Li, & Wang, 2016). Psychological status includes levels of anxiety and depression, while daily experiences include negative impact on academic perfomance and relationships (Jin Li, Zhou, Li, & Wang, 2016).

Mindfulness

There are few accessible and available treatment options for mental health challenges and sleep problems, however many students do not get treatment at all (Zochil & Thorsteinsson 2018). Mindfulness is a fairly accessible and available treatment option that can overcome these challenges for students (Soriano-Ayala et al., 2020; Black et al., 2021;

Baer 2003). Raab, Sogge, Parker, and Flament (2015) define mindfulness as paying attention to the present moment. Mindfulness practice includes focus on breathing and awareness of the body. There is a strong evidence in the literature (Table 1.1) that mindfulness has a positive effect on a wide range of physical and mental conditions. The benefits of mindfulness, according to literature (Table 1.1), includes reduction of aggression, stress, anxiety and depression; improving of cognitive perfomance, attention, memory and concentration; building of meaningful relationships; managing difficult feelings; building resilience; emotional regulation and clarity; and helping to control heart rate and blood pressure.

Recent neuroscientific studies on the brain show evidence that mindfulness can alter the function and structure of the brain, together with improvement on quality of life and total wellbeing (Hölzel et al., 2011; Keng 2011; Remmers et al., 2018; Bajaj, Robins & Pande, 2016**)**. Mindfulness is appealing because it is easily accesable and can treat a variety of mental health issues (Baer 2003). Mindfulness is a process that integrates mind and body to improve wellbeing and mental health of individuals. It is associated with openness to experiences, emotional intelligence, self-esteem, optimism, positive affect, life satisfaction, self-compassion, optimism, vitality, self-actualization, autonomy, competence, and fulfillment (Shearer, Hunt, Chowdhury, & Nicol, 2016). Amongst these positive effects, mindfulness has also been used to improve sleep (Soriano-Ayala et al., 2020). The study by Black et al. (2021) concluded mindfulness could improve sleep quality and sleep disturbances, after evaluating whether mindfulness was effective to moderate sleep problems among older adults with moderate sleep disturbances.

Study objectives

The objective of this study was to evaluate mindfulness as an intervention for poor sleep, academic performance, and mental health challenges in university students.

CHAPTER 2

LITERATURE REVIEW

Mental health of students

Mental health problems remain one of the biggest challenges for university students. The most common mental health issues among university students includes anxiety, depression, suicidality, and substance use (Cook, 2007; Larovici, 2014; Lawal, 2018; McAllister at al., 2014; Storrie et al., 2010; Pillay et al., 2020).

Depression and anxiety in students

Depression and anxiety are worldwide challenges. According to Xu, Zhu and Liu (2019), over 300 million people globally live with depression. Kingston et al. (2007) describes depression as a clinical condition that 80% of individuals experience at least once in their lifetime. There is also a high prevalence of anxiety and depression among university students (Greeson et al., 2014). According to reports from SADAG (2019) one in every four university students in South Africa has been diagnosed with depression and or anxiety disorder. The study by Greeson et al. (2014) indicates that 50% of university students suffer from depression and anxiety. Shambu, Rajesh and Subramanya (2018) adds that depression has become a prevalent mental disorder among youth. The prevalence of depressive episodes among the youth have increased by 8,7% between 2005 and 2014 (Mojtabai 2016). While the prevalence of anxiety disorders is equally high amongst youth and students (Xu, Zhu & Liu, 2019; Crowley et al., 2018). SADAG (2019) shows both depression and anxiety affect all races, ages, genders, and religious groups, which has led to the rise of suicides in the university campuses in South Africa. Auerbach et al. (2018) suggests little has been done to deal and identify mental disorders in university campuses across the globe. Most cases of

depression and anxiety among university students are left untreated. According to SADAG (2019), 40% of university students that experience mental health challenges do not seek help.

The main factors that contribute as triggers to these disorders include poor coping strategies regarding academics demands, relationship problems, family challenges, substance abuse, financial problems, chronic illness, abuse, trauma, grief, and loss (Auerbach et al., 2018; Bantjes et al., 2016; Brougham, et al., 2009; Cruwys, Greenway, & Haslam. 2015; Gaultney, 2010; Stallman & Hurst, 2016; Tsui & Wing, 2009). Depression is known to be one of the leading causes of students dropping out of university. If it is left untreated it can lead to other mental illnesses and suicidal ideations due to feelings of helplessness and despondency. In as much as symptoms of depression differ from person to person, they include extreme sadness and unhappiness, loss of appetite, isolation, fatigue, loss of energy, guilt, anger, frustration, suicidal ideation, and excessive drinking. On the other hand, anxiety or anxiety disorder disrupt one's ability to fully function because of severe feelings of stress and fearfulness. The emotional symptoms for anxiety may include feelings of stress, a deep sense of fear, worries and irritability while physical symptoms include severe headaches, muscle pains, diarrhoea, lack of concentration, shortness of breath, fast heart rate, sweating and dizziness (American Psychological Association, 2013; Bantjes et al., 2016; Auerbach et al., 2018; Stallman & Hurst, 2016; Lawal, Idemudia & Senyatsi, 2018; Shahzeb & Khan, 2016; Zochil & Thorsteinsson, 2018; Jithoo, 2018; Shambu Rajesh & Subramanya, 2018; Xu, Zhu & Liu, 2019).

Sleep impacts mental health

In addition to having mental health challenges, many university students experience poor quantity and quality of sleep (American Psychological Association, 2013; Bantjes et al., 2016; Hayley, Sivertsen, et al., 2017; Jin Li, Zhou, Li, & Wang, 2016; Stallman & Hurst, 2016; Simor, Krietsch, Köteles, & Mccrae, 2015). Lukowski and Milojevich (2015) contends

that university students get far less sleep than high school students. About 60% of univerisity students suffer from poor sleep quality, while 7,7% meet the criteria for insomnia disorder (Schlarb, Friedrich & Claben, 2017). A study done by Hershner and Chervin (2014) indicates that 50% of university students reported daytime sleep, while 70% reported to have insufficient sleep.

Research done by Marina & Einar (2018) shows that there is a bidirectional relationship between decreased sleep quality and elevated levels depression, anxiety and stress. Research findings show that depression, anxiety and stress in students can cause poor sleep (Jin Li, Zhou, Li, & Wang, 2016; Stallman & Hurst, 2016). However, students who are experiencing poor sleep are more vulnerable to experiencing these psychological difficulties. For example, one study by Ramos et al. (2021) evaluated poor sleep quality and excessive daytime sleepiness, and its association with mental health in college students. This study indicated that students who had sleep problems were almost twice as likely to have depression or experience moderate to high stress levels. Another study by Ghrouz et al. (2016) examined the associations and interactive effects of physical activity and sleep quality on mental health among Indian college students. This study concluded that there is a significant association between sleep quality and mental health.

Furthermore, poor quantity and quality of sleep can impact academic performance (Schlarb, Friedrich & Claben, 2017). According to Hayley et al. (2017) poor quantity or quality of sleep can reduce neurocognitive capacity of students which will impair their capacity to manage with academic performance. Generally good sleepers show better academic performance than those students who have sleep problems (Hayley et al., 2017).

Mindfulness is a useful tool for improving sleep and mental health

While some people choose medication to help manage their sleep and mental health challenges, not everyone can afford medication and in some instances, medication does not help to resolve the mental health and sleep problems (Black et al., 2015). Mindfulness is an alternative to pharmacological treatment of sleep problems, which can result in improved mental health challenges (Black et al., 2015; Felver, Morton & Clawson, n.d.). Research suggests that mindfulness can be used as an intervention that can improve sleep problems, which eventually could improve mental health of individuals, vice versa (Feinholdt & Annika, 2015; Wall, 2005; Biegel, 2009; Bootzin & Stevens, 2005). Furthermore, other studies suggest relaxing the mind and body through mindfulness exercise is a good idea to get a better quality of sleep (Carlson & Garland, 2005; Felver, Morton & Clawson, n.d.; Ong et al., 2014; Shearer, Hunt, Chowdhury, & Nicol, 2016). Research suggests mindfulness has a positive result for improving sleep with those suffering from clinical insomnia (Hubbling, Reilly-Spong, Kreitzer, & Gross, 2014; Ong et al., 2007; Skaer & Nwude, 2014). Dahl et al. (2016) indicates that there is enough evidence that proves mindfulness protocols for successfully treatment of sleep problems. Dahl et al. (2016) further propose that some research on effects of mindfulness on sleep show a significant improvement on measurements of sleep latency and sleep efficiency.

Mindfulness has been found to have significant positive effect on the mental health of both depressed and non-depressed individuals (Bamber & Schneider 2016; Cangas 2014; Keng 2011). It has proven to improve the health of those who are at risk of depression, anxiety together with those who suffer from negative thoughts and feelings (Wall, 2005; Biegel, 2009; Bamber & Schneider 2016; Cangas 2014; Keng 2011). Mindfulness has also shown good results to individuals who have shown treatment resistance to pharmacological treatment for depression (Black et al., 2015; Felver, Morton & Clawson, n.d.; Keng 2011).

Mindfulness also helps to reduce negative affect and maladaptive automatic responses, which reduces anxiety caused by negative thoughts while allowing more rational and positive thoughts **(**Keng 2011). Concurrently it improves positive affect, and studies show the effect of mindfulness training in brain areas responsible for affect regulation (Remmers et al., 2018; Bajaj, Robins & Pande, 2016). These areas include the pre-frontal cortex which is responsible for planning, problem solving and control of emotions. Magnetic Resonance Imaging (MRI) has shown that mindfulness increases white matter in the anterior cingulate cortex and gray matter density of the left hippocampus in the brain **(**Hölzel et al., 2011; Keng 2011; Remmers et al., 2018**)**. The anterior cingulate cortex host cognitive functions, which includes emotional expression, attention allocation, and mood regulation. While gray matter density of the left hippocampus is responsible for the control emotional regulation and learning).

Mindfulness Based interventions (MBIs) have been found to be crucial mindfulness tools that offer good results for addressing both psychological and physiological problems (Creswell, 2017). MBIs are also often recommended for improving sleep quality and sleep duration (Ong et al., 2014). MBI is a type of a meditation whereby one focuses intensely on own senses and feelings in the moment (Kabat-Zinn, 2003). In studies conducted by Hall et al. (2018) and Hulsheger et al. (2014), MBIs were found to be effective in both reducing depression, stress, and anxiety together with improving the quality of sleep. To date, there are gaps in literature about the comprehensive shared understanding of MBIs, as a result there is no one single definition and protocol for conducting MBI.

MBIs can be used in helping students with their academic demands. It can help university students by reducing anxiety during exams which can result in their academic success. According to Hayley et al. (2017) students often show elevated anxiety during the

period of exam, which can hamper their academic performance, hence mindfulness intervention can help to reduce their elevated anxiety state.

However, some studies have contrary views about the effective of mindfulness. A systematic review of empirical support for mindfulness interventions for common psychiatric disorder by Lagerlof, Lagerlof & Ost, 2017 concluded that the scientific empirical evidence was weak for mindfulness treatment of depression and anxiety. Toneatto and Nguyen (2007) agree that mindfulness-based therapy does not influence anxiety and depression. While Bajaj, Robins and Pande (2016) found no correlation between mindfulness, anxiety and depression. Strauss, Cavanagh, Oliver and Pettman (2014) suggest that mindfulness intervention does not always show success in reduction of anxiety symptoms. In terms of mindfulness and sleep, Li, Kee and Lam (2018) warns that mindfulness will improve overall sleep quality but not sleep duration. Carsello and Creaser (1978) found no significant effect of mindfulness on academic performance. Hence, there is some disagreement in the literature regarding the efficacy of mindfulness treatment for both mental health difficulties such as depression and anxiety as well as sleep disruption.

In summary, the literature discussed above elaborated on the negative effects of poor sleep and mental health problems (depression and anxiety) among university students and subsequent associations to poor academic performance. The literature also recommends mindfulness as an accessible treatment used to improve sleep, which may act to reduce mental health difficulties such as depression and anxiety, and improve academic perfomance among university students. Since there is some disagreemnt in the literature regarding the effects of mindfulness and there is little research on the impact of midfulness on sleep quality and duration with the specific intention of improving mental health and academic performance, therefore a study is required to test these associations. Below is a table of summary of

systematic literature as supplementary to the above literature review about the effectiveness of mindfulness.

Table 1.1

Summary of systematic literature review on mindfulness interventions in mental health and cognitive performance

Citation	**Purpose**	**Sample**	**Intervention**	**Measures/ Instrument**	**Outcomes**	**Limitations**
Alkoby et al., 2018	Mindfulness-based stress reduction workshop increases regulatory choice flexibility	N = 111	MBSR	Mindfulness	The regulatory choice patterns of participants who underwent MBSR training were found to be more flexible than those of participants who had not yet completed the workshop	Pre-manipulation differences in trait mindfulness between the MBSR group and the control group
Baer, 2003	Empirical review of mindfulness raining as a clinical intervention		MBSR	Empirical literature investigating	Mindfulness-based interventions may help to alleviate a variety of mental health problems and improve psychological functioning.	
Bajaj, Robins & Pande., 2016	Examine mediating effects of self-esteem on the relationship between mindfulness and depression.	N = 417		MAAS, RSES, DASS	Results show that mindfulness has a negative relationship with anxiety and depression but positive relationship with self-esteem.	Difficult to draw causal relationship on the variables and data relied on exclusively self-report measures.
Bamber & Schneider, 2016	Review the research testing the effects of mindfulness meditation on	57 studies		Narrative synthesis	Mindfulness shows reduction in stress and anxiety in college students.	Need for quantitative examination of the

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
	stress and anxiety in the college students.					differences in interventions as a result of frequency, duration, and instruction method adds inclusion of yoga.
Banks, Newman, & Saleem, 2015	Review on mindfulness-based interventions for treating symptoms of posttraumatic stress disorder	Literature study			The use mindfulness-based approaches to treat PTSD symptoms may be useful	The studies varied in terms of trauma populations and severity of PSTD symptoms and diagnosis
Beauchemin, Hutchins & Patterson, 2008	Evaluates if Mindfulness Mediation (MM) lessens anxiety, promote social skills and improves academic performance among adolescents with learning disabilities.	N = 34	MM		State and trait anxiety decreased significantly from pre-test to post- test. There was also an improvement in social skills and academic performance.	The control group was deemed unethically of impractical.

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
Berghoff et al., 2017	Evaluation of the contribution of values clarification to a brief mindfulness meditation (MM) intervention for anxiety.	N = 120	MM	STICSA. QOLI. DVAQ	There was significant a decrease in anxiety symptoms frequency and increase in quality of life.	No firm conclusion can be reached regarding addition of value-based strategies to MM.
Blake et al., 2016	Investigate the post-intervention effects of a cognitive-behavioural/mindfulness-based group sleep intervention on sleep and mental health among at risk adolescents	N= 140			A multicomponent group sleep intervention that includes cognitive-behavioural and mindfulness-based therapies can reduce sleep initiation problems and related daytime dysfunction	
Bodenlos et al., 2013	Examine the relationship between mindfulness and alcohol problems in college students, as well as the role of stress as a mediator in this relationship.	N =310	Self-assessment	PSC, Five Facet Mindfulness Questionnaire, and the Rutgers Alcohol Problems Index	Mindfulness-based stress reduction or other mindfulness programs may be useful in decreasing alcohol problems on college campuses via the effects on stress	Study was cross-sectional therefore causality between variables cannot be determined. Confounding variables such as negative mood states (eg, depression) or

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
						personality traits were not accounted for.
Call, Miron & Orcutt, 2014	Mindfulness Based Stress Reduction (MBSR) on stress and anxiety	N=91	MBSR and Yoga		MBSR and Yoga shows a significant decrease in anxiety	There were significant differences in pre-intervention group
Carlson & Garland, 2005	Impact of mindfulness-based stress reduction on sleep mood, stress fatigue symptoms in cancer outpatients.	N =63	MBSR	POMS, SOSI, PSQI	Overall sleep disturbance was significantly reduced, and participants reported that their sleep quality has improved. There was also a reduction in stress and mood disturbance.	There was a lack of a specific measure to assess fatigue. There was no follow up assessment included thus it is uncertain whether the improvements gained will be maintained over time.

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
Crowley et al., 2018	An open trial to assess effectiveness of group mindfulness therapy (GMT) for adolescents in a school setting.	N =11	GMT	CBCL. SCARED: YSR	Significant reduction in anxiety, stress and improved attention was observed.	Limited by a single group comparison.
Dariotis et al, 2017	Exploration of implementation factors in a school-based mindfulness and yoga program	N = 122	School-based mindfulness Yoga		Scheduling programs strategically within the school day. Obtaining appropriate physical setting and promoting buy-in from teachers and students.	Only students who provide parents' permission participated in the original intervention study
Delgado-Pastor et al., 2015	Study aims at testing the specific contribution of two components of mindfulness -attention to cognitive experience (metacognition) and awareness of interoceptive sensations (metainteroception) in the treatment of chronic worry.	N = 45	Mindfulness	Penn State Worry Questionnaire, physiological indices of autonomic regulation (skin conductance, heart rate, heart	Both mindfulness training groups showed significant improvement after the intervention in self-report indices of mindfulness and clinical symptoms.	Small sample size may have increased the probabilities of type I and II errors, intervention program was relatively short, the participants were all female

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
				rate variability, and respiratory sinus arrhythmia) and self-report indices.		
Dhanalakshmi, 2019	Evaluation of Mindfulness Based Stress Reduction (MBSR) to reduce anxiety, improve sense of coherence, optimism and general health among students.	N = 30	MBSR	GHQ12. Personal data sheet; Depression and anxiety for youth scale; sense of coherence; optimism scale	Mindfulness intervention can reduce anxiety while it improves sense of coherence, health and optimism.	Sense of coherence could not be controlled completely.
Dvorakova et al., 2017	Evaluate the effectiveness and feasibility of mindfulness training aiming to promote first year college students' health and wellbeing.	N = 109	L2B	PHQ, MASS, PSQI, GAD,	Mindfulness-based programs may be an effective strategy to enhance a health transition into college.	The study is not generalizable.

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
				SCS		
Edwards et al, 2014	Examining the Effects of a Mindfulness Group on Latino Adolescent Students	N = 20	MBSR–T	MAAS, STAI	Adolescents increased self-compassion and reduced symptoms of stress.	Small number of participants, self-report measures were used in this study
Franco et al., 2010	Evaluate the effects of mindfulness program on academic performance.	N = 61	Mindfulness Program	STAI	Significant reduction in state and trait anxiety together with increase in academic performance and improved self-concept.	Cannot generalise the study because of the small sample size.
Gallego et al., 2014	Evaluating effect of a mindfulness program on stress, anxiety and depression in university students	N = 125	Mindfulness	DASS-21	The reduction effects of identified variables were higher for the intervention group compared to the control group.	
Franco et al., 2010	Evaluate the effects of mindfulness program on academic performance.	N = 61	Mindfulness Program	STAI	Significant reduction in state and trait anxiety together with increase in academic performance and improved self-concept.	Cannot generalise the study because of the small sample size.
Gallego et al., 2014	Evaluating effect of a mindfulness program on stress, anxiety and depression in university students	N = 125	Mindfulness	Abbreviated Depression, Anxiety and	The reduction effects of identified variables were higher for the intervention group compared to the control group.	

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
				Stress scale (DASS-21)		
Golberg et al., 2017	A systematic review of mindfulness-based interventions (MBI's) for psychiatric disorders.	N = 142	Literature search (MBI)	Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA)	Studies show consistent evidence that supports mindfulness for depression, pain conditions, smoking and addictive behaviours hence MBI's holds promise as evidence-based treatments.	
Hazlett-stevens & Oren, 2017	Examine the effectiveness of a self-help of bibliotherapy	N = 47	MBSR	CCAPS-34, FFMQ, DASS21, PSS, ASI, PSWQ, AAQ-II	The MBSR workbook may provide an acceptable and effective alternative for motivated individuals seeking to reduce stress.	Differential attrition rate found between the groups.
Hjeltnes, Binder, Moltu & Dundas, 2015	Investigate subjective of 29 university students who participated in an 8-week mindfulness-based	N = 29	MBSR		Group reported finding inner source of calm during anxious and stressful times, feeling.	Qualitative study is not the best method to demonstrate the causal effect of MBSR on

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
	stress reduction (MBSR) program for academic evaluation anxiety.					anxiety and academic performance.
Hindman, Glass & Arnkoff, 2015	Comparison of Formal and Informal Mindfulness Programs for Stress Reduction in University Students	N = 34	MSM	BQ, FFMQ, MAAS, AAQ-II,	Both interventions were effective in reducing stress for university students, but results demonstrated the superiority of MSM over MSM-I.	Small sample size, restricted demographic range of the sample in that most students were female, Caucasian, and in their 20s.
Hofmann Sawyer, Witt & Oh, 2010	Conduct effect of mindfulness-based therapy (MBT) on anxiety and depression.	39 studies	MBT	Selection of studies	MBT effective for improving anxiety and other mood disorders.	The study was limited to meta-analytic technique which determined quality of included studies.
Hou, Ng & Wan, 2015	examined whether and how changes in positive affect and mindfulness predicted changes in cortisol secretion and psychological	N = 105	Mindfulness	CAS-PA, MAAS, STAI, PSS,	The levels of post-stress recovery from anxiety symptoms could depend on concurrent increases in positive affect and mindfulness, whereas the levels of post-stress decline in	a small convenient sample, salivary samples were collected only on a single day

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
	distress in adaptation to examination stress.			salivary samples self-report,	cortisol secretion could depend on increases in mindfulness both during and after stress	
Hozel et al., 2011	Examining how mindfulness Meditation work both mechanisms of action from a conceptual and neural perspective			Literature review	mindfulness meditation practice comprises a process of enhanced self-regulation that can be differentiated into distinct but interrelated components, namely, attention regulation, body awareness, emotion regulation (reappraisal and extinction), and the change in perspective on the self.	
Hubbling, Reilly-Spong, Kreitzer, & Gross, 2014	How mindfulness changed my sleep on focus groups with chronic insomnia patients	N = 18		MBSR	Mindfulness training in a group format, combined with sleep hygiene education is an important for effective application of MBSR as treatment of insomnia	Lack of gender and racial diversity are study limitation
Hulsherger, Feinholdt & Nubold, 2015	Investigate be effectiveness of low-dose mindfulness intervention for recovery from work	N = 148	Self-training intervention	Trait mindfulness Psychological detachment	No effects found for psychological detachment after work and for the proposed treatment-by-baseline interaction	The wait list control group design which is common for initial tests of

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
				Sleep quality and duration		psychological interventions may create expectation biases
Jacobs et al., 2017	Does mindfulness skills reduce stress among a diverse paraprofessional workforce	N = 26			Mindfulness-based intervention may be useful in supporting the wellbeing of paraprofessionals from diverse background in low-income urban environments.	No control group to allow testing of observed changes
Khaddouma, Gordon, & Strand, 2017	Relationship effects of mindfulness-based stress reduction on participants and their partners	N = 52	MBSR	Mindfulness Relationship satisfaction	Increasing level of mindfulness may have positive effect on couples' relationship satisfaction	Lack of a comparison or control group, which makes it impossible to determine whether changes in mindfulness and relationship satisfaction were

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
						attributable to MBSR program participation
Khoury et al., 2013	To evaluate the efficacy of MBT	209 studies		Systematic review	MBT is an effective treatment for a variety of psychological problems, and is especially effective for reducing anxiety, depression, and stress.	Included studies with different levels of quality, meta-analysis only included mindfulness meditation protocols which limiting the scope of the results to this practice.
Kingston et al., 2007	Assess the efficacy of mindfulness based cognitive therapy (MBCT) in reducing depressive symptoms in psychiatric outpatients with recurrent depression.	N = 19	MBCT	BDI;	Results shown significant effect on reduction of residual depressive symptoms.	The study sample was small, groups were not randomized, and diagnoses were not formally objectively assessed.

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
Lagor et al, 2013	to document lessons learned from a mindfulness-based intervention with Chronically I11 youth	N = 13		CAMM Pediatric quality of life inventory	The study showed improvement between the pre-intervention and the post-intervention	Absence of control group
Lau & Hue, 2011	to examine the possible impacts of a six-week mindfulness programme for improving the psychosocial condition of adolescents, and its feasibility in the local school settings.	N = 50	MBSR	MAAS, SPWB, DASS, PSS	Mindfulness programme was related to the improvement of the psychosocial situation of the adolescents	Small sample short-term follow-up
Leland, 2015	Evaluation whether mindfulness can be valuable for helping students to be more successful academically.	Literature Review			Mindfulness has a positive impact on academic performance.	
Li, Kee & Lam, 2018	Evaluating the effectiveness of brief mindfulness induction on university athletes sleep quality following night training.	N = 63	PASA	PSIQ Rating Perceived Exertion scale, PASA,	Brief mindfulness reduces sleep arousal and improves sleep quality but not duration	Study participants came from four teams after a high intense night training, gender effects were not extensively evaluated.

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
				State Version of Mindful Attention Awareness, Sleep Diary		
Liehr & Diaz, 2010	Examining the effect of mindfulness on depression and anxiety for minority children	N = 18	Mindfulness intervention	The Short Mood, SMFQ, STAI	Mindfulness decreases particularly depressive symptoms in minority children.	Small sample size
Lin & Mai, 2018	The impact of mindfulness mediation (MM) intervention on academic performance.	N = 441	MM	Database theory and application	MM significantly improves short term academic performance but does not significantly improve long term academic performance.	The use of self-reporting questionnaire might be prone to biased responses.
Lu, Huang & Rios, 2017	Examining the relationship between mindfulness and academic performance.	N = 219	Mindfulness	MAAS. Academic performance	Mindfulness has strongly significant correlation with executive function which has direct relationship with academic performance.	Sample with two migrant groups and the use of mindfulness attention awareness scale.

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
Lu, Huang & Rios, 2017	Examining the relationship between mindfulness and academic performance.	N = 219	Mindfulness	MAAS; academic performance	Mindfulness has strongly significant correlation with executive function, which has direct relationship with academic performance.	Sample with two migrant groups and the use of mindfulness attention awareness scale.
McCloskey, 2015	Analyze the role of mindfulness and met awareness in relation to the etiology of executive functioning disorders.	Literature review			Recent literature supports the use of mindfulness as tools to help students with executive functioning deficit.	
Ong & Sholtes, 2010	Mindfulness-based approach to the treatment of insomnia	N =	MBT- I		Mindfulness principles can improve chronic insomnia.	Lack of control group and lack of specificity of treatment mechanisms need to be addressed in studies before MBT-I can be routinely recommended as an efficacious treatment.

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
Semple et al.,2010	Exploring Mindfulness-Based Cognitive Therapy for children to promote mindful attention to Enhance social-emotional resiliency in children	N = 25	MBCTC	CBCL, MASC, STAI-C	MBCT-C is effective in reducing attention-related problems and shows promise in managing anxiety symptoms and behaviour problems in children with clinically elevated levels of anxiety.	There were no clinical diagnoses for anxiety disorders or attention deficit disorders.
Shambu Rajesh & Subramanya, 2018	To examine association between mindfulness and psychological factors among adolescent orphans.	N = 140	Measuring instruments	CAMM, CFS, SMFQ	Significant correlation between mindfulness and depression was observed among the adolescence.	
Shanok, Reive, Mize & Jones, 2019	Exploring mindfulness meditation intervention (MMI) to alter neurophysiological symptoms of anxiety and depression in pre-adolescence	N = 66	MMI	BIS/BAS, PANAS	The self-report depression scores showed reduction after the intervention which indicated change in the conscious behavioural level.	There was no sufficient active control group, the effects of mindfulness in this study may be pertinent to individuals with a certain type of anxiety disorder.
Shao & Skarlicki, 2009	Examine whether mindfulness was related to performance among	N = 149		MAAS,	mindfulness was not associated with performance either as a bivariate correlation	Response rate was low,

MBCTC, CBCL, MASC, STAI-C, CAMM, CFS, SMFQ, BIS, BAS, PANAS, MMI, MAAS

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
	a group of MBA students			academic performance	or when controlling for other predictors, mindfulness was positively related to performance for women but not for men	No way of knowing whether response bias affected the results, 70% if the participants were men.
Shearer, Hunt, Chowdhury, & Nicol, 2016	Exploring effects of a brief mindfulness meditation intervention on student stress and heart rate variability	N = 24	MBSR	STAI, BDI, PANAS-X, FFMQ	A short mindfulness training program can be a powerful yet simple way to help college students cope with stress and anxiety. Not only does practicing mindfulness meditation appear to significantly lower anxiety in the moment.	Data was lost, self-reporting
Strauss, Cavanagh, Oliver & Pettman, 2014	Explore Mindfulness-Based Interventions for People Diagnosed with a Current Episode of an Anxiety or Depressive Disorder:	12 studies		Quantitative synthesis	Significant benefits relative to control conditions for primary symptom severity for people experiencing a current episode of depression following MBIs (namely MBCT or PBCT).	Small sample size

Citation	Purpose	Sample	Intervention	Measures/ Instrument	Outcomes	Limitations
Vesa, Liedberg & Ronnlund, 2016	examined the effects of a short-term web-based mindfulness program	N = 70	Mindfulness	PSQ	Mindfulness training increased mindfulness skills and reduced levels of perceived stress, anxiety, and depressive symptoms	

CHAPTER 3

METHODS

Research Aim

The aim and the rationale for this study was to evaluate mindfulness as an intervention for poor sleep with the final goal of improving psychiatric symptoms and improving academic performance in university students. This study was conducted during the period when students where writing tests and exams, a time when students stress levels are elevated. The academic demands during exams times may lead to deterioration of the quantity and quality of sleep among university students (Chambell, Soenens, Beyers & Vansteenkiste, 2018). It is well known that poor quality and quantity of sleep has a direct negative impact on mental health status (Simor, Krietsch, Köteles & Mccra, 2015). Therefore, it was an ideal time to apply an intervention which may improve sleep quality, and by association, mental health.

Study Design

The study was part of a larger project which investigated two central questions. The first question, which was investigated by a colleague, focused on a mindfulness intervention to increase university students' resilience through sleep improvement, while this study focused on using the intervention to improve mental health outcomes (depression and anxiety symptoms) of university students through the same mechanism.

This quantitative intervention took an open label between-group design. Participants were assigned to either the control or the intervention group. The intervention group practised a mindfulness technique for 1 week while the control group did not receive any treatment. The mindfulness intervention was the independent variable, while sleep quality; depression levels; anxiety levels and academic performance were the dependant variables.

Participants

This study used a convenience sampling approach. Participants were recruited from UCT's Department of Psychology and the general UCT student population via an email advertisement (see Appendix 1) that was disseminated to all the students through the Department of Student Affairs. The total number of volunteers recruited for this study was 257, although only = 39 participants met the inclusion criteria. From the 218 who did not meet the criteria, 32 showed symptoms of post-traumatic stress disorder (PTSD), 22 showed symptoms of depression, 19 tested positive for alcohol use disorder, 21 had significant sleep difficulties, 21 showed significant symptoms of anxiety and 103 were excluded for other reasons. These include being (a) a postgraduate student that did not write exams, (b) on chronic medication, (c) diagnosed with a mental health condition and (d) having been involved in meditation related activities in the last two years. Of the final 39 participants, only one student dropped out and 38 completed the study. Figure 3.1 below shows a flow of participants through the experiment from recruitment to group allocation.

G*Power was used to determine the required number of participants to observe any meaningful statistical results in the data (Faul, Erdfelder, Buchner, & Lang, 2009). Using two-tailed repeated measures for two equal sized groups (experiment group and control group), a probability of .05; a medium effect size ($f = 0.25$); and a power ($1 - \beta$ err prob) of 0.95, results revealed the total sample size should be set at n = 34. I recruited $n = 38$ to cater for any dropouts. The participants were divided to two groups, $n = 20$ were assigned to the intervention group, while $n = 18$ to the control group.

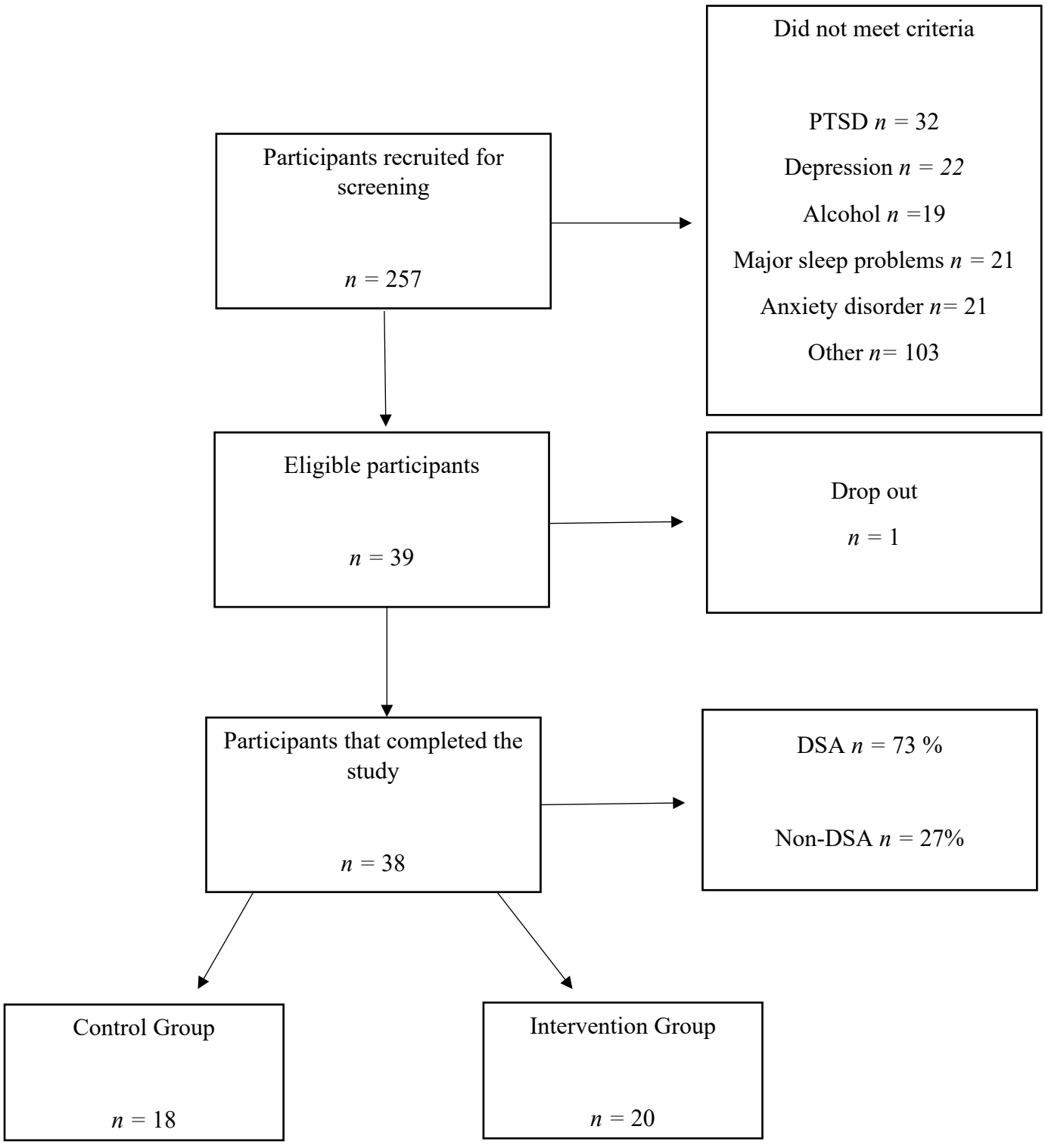

Figure 1. Flow of participants through the study protocol from recruitment to study conclusion. PTSD = post-traumatic stress disorder; DSA = department of student affairs

Inclusion and exclusion criteria. The inclusion criteria for participating in this study were an age between 18 and 40 years and fluency in English. Participants aged older or younger than this range have different typical sleeping patterns (Valiensi et al., 2019), which would confound the results of this study. Furthermore, many of the measures used in this study do not have other-language translations. Participants were also excluded if they had good or extremely poor sleep quality (as determined by PSQI); severe anxiety or depression; history of psychosis; use of psycho-active drugs; any neurological disorders known to affect sleep/mental health outcomes; substance use disorders and severe post-traumatic stress disorder (PTSD).These set criteria were considered for exclusion of participants because these may have potentially had an independent effect on sleep and mental health (Conroy & Arnedt, 2014; Davies et al., 2017; Morin & Ware 1996)

Materials and Apparatus

Diagnostic and screening instruments. The study used 8 screening and experimental measures. The measures used during the pre-test included the Alcohol Use Disorders Identification Test Consumption (AUDIT-C); The Primary Care PTSD (PC-PTSD); Pittsburgh Sleep Quality Index (PSQI); Patient Health Questionnaire-9 (PHQ9) and the State & Trait Anxiety Index (STAI; but only State Index was used). The measures used during the intervention and/or post- test included a Sleep diary; pre and post intervention exam or test marks; Pittsburgh Sleep Quality Index (PSQI); Patient Health Questionnaire-9 (PHQ9); State & Trait Anxiety Index (STAI; but only State Index was used).

Alcohol Use Disorders Identification Test Consumption (AUDIT-C). The AUDIT was developed and evaluated over a period of two decades through work of the World Health Organization, and it has been found to provide an accurate measure of risk of harmful drinking across gender, age, and cultures (see Appendix 8). It assesses the frequency and quantity of drinking of individual. The item content of the AUDIT-C consists of 10 questions

about recent alcohol use and alcohol dependence symptoms. The scale is scored on a scale of 0-12. The higher scores indicate individuals who may alcohol dependency and elevated levels of alcohol consumption. In this study the AUDIT to exclude participants with high consumption levels. The AUDIT-C cut-off score for women is = 5 or more and for men is = 7 or more. The AUDIT has been used in studies conducted in South Africa to describe the prevalence of risky drinking (Labadarios, 2018; Peltzer et al., 2014).

Primary Care Post-Traumatic Stress Disorder Screen (PC-PTSD). The Primary Care PTSD Screen is a 5-item screen, designed to identify individuals with probable PTSD in primary care settings (see Appendix 7). Positive screening results require further assessment, preferably with a structured interview. The initial aim of the instrument is to assess whether the respondent has had any exposure to traumatic events. If a respondent denies exposure, the PC-PTSD-5 is complete with a score of 0. If a respondent indicates a trauma history – experiencing a traumatic event over the course of their life – the respondent is instructed to answer five additional yes/no questions about how that trauma has affected them over the past month. Preliminary results from validation studies suggest that a cut-point of 3 on the PC-PTSD-5 (e.g., respondent answers "yes" to any 3 of 5 questions about how the traumatic event(s) have affected them over the past month) is optimally sensitive to probable PTSD. Optimizing sensitivity minimizes false negative screen results. Using a cut-point of 4 is considered optimally efficient. Optimizing efficiency balances false positive and false negative results (Cameron & Gusman, 2003). Students who answered "yes" to 3 or more of the questions were excluded because that indicated a possibility of PTSD. The PC-PTSD displays good criterion validity having (a) shown diagnostic ability 85% concurrent with the Trauma Screening Questionnaire, which is known to be a comprehensive measure of PTSD: (a) demonstrated good test-rest reliability ($p < .001$) and (b) demonstrated excellent

diagnostic accuracy (Prins et al., 2016). The study by Pertzer et al. (2013) is one example of a study that shows the PC-PTSD has been used successfully in the South African context.

Pittsburgh Sleep Quality Index (PSQI). The Pittsburgh Sleep Quality Index (PSQI) is an instrument used to measure sleep quality in adults. It differentiates "poor" from "good" sleep by measuring seven domains: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleep medication, and daytime dysfunction over the last month (see Appendix 4). The participant self-rates each of these seven areas of sleep. Scoring of the answers is based on a 0 to 3 scale, whereby 3 represent worse sleep. A global sum of "5" or greater indicates a "poor" sleeper. In our study students who scored <5 or > 12 were excluded as we wanted to show a change in sleep quality and required participants to have moderate sleep disruption. The PSQI has good internal consistency and a reliability coefficient (Cronbach's alpha) of 0.74 for all components (Manzar et al., 2015). Numerous studies using the PSQI in a variety of populations internationally have supported high validity and reliability. For example, Backhaus et al. (2002) showed that test-retest reliability was .87. Validity analyses showed high correlations between PSQI and sleep log data and lower correlations with polysomnography data. A PSQI global score > 5 resulted in a sensitivity of 98.7 and specificity of 84.4 as a marker for sleep disturbances in insomnia patients versus controls. The study concluded that PSQI has a high test-retest reliability and a good validity for patients with primary insomnia. PSQI has been used successful in the South African context as indicated by some studies including Reman, Karsaedt, & Scheuermaier (2018).

Patient Health Questionnaire – 9 (PHQ9). The PHQ-9 indicates symptoms of depression in adults following the criteria for a Major Depressive Episode listed in the DSM-V (see Appendix 6). Symptom severity is rated by indicating the frequency that depressive symptoms have been experienced during the last 2 weeks on a scale of 0 "*Not at all*" to 3

"*Nearly every day*". An additional single item is rated to determine the impact of depressive symptoms on psychosocial and occupational functioning. Student who scored ≥ 15 were excluded from the study since their score would indicate moderately severe to severe depression The study conducted by Botha (2011) evaluated the reliability and validity of PHQ-9 in the South African context. The PHQ–9 demonstrated Cronbach Alpha reliability index of 0.86. Criterion–related validity was supported by significant correlations between the PHQ–9 and criterion measures indicating that the PHQ–9 may be a valid measure to identify depression in a South African context.

State & Trait Anxiety Index (STAI). The STAI measures the presence and severity of self-reported current symptoms of anxiety and a generalized propensity to be anxious (see Appendix 5). There are 2 subscales within this measure. First, the State Anxiety Scale (S-Anxiety) evaluates the current state of anxiety, asking how respondents feel "right now," using items that measure subjective feelings of apprehension, tension, nervousness, worry, and activation/arousal of the autonomic nervous system. The Trait Anxiety Scale (T-Anxiety) evaluates relatively stable aspects of "anxiety proneness," including general states of calmness, confidence, and security. The STAI has 40 items, 20 items allocated to each of the S-Anxiety and T-Anxiety subscales. Responses for the S-Anxiety scale assess intensity of current feelings "at this moment": (1) not at all, (2) somewhat, (3) moderately so, and (4) very much so. Responses for the T-Anxiety scale assess frequency of feelings "in general": (1) almost never, (2) sometimes, (3) often, and (4) almost always. Students who scored ≥ 59 on the trait component were excluded as this may be an indication of severe anxiety. The study by Spielberger, Gorsuch et al. (1983) indicated internal consistency coefficients for the scale ranging from 0.86 to 0.95 while the test-retest reliability coefficients ranged from 0.65 to 0.75 over a 2-month interval. Test-retest coefficients for this measure attests to the

construct and concurrent validity of the scale. The study by Shah (2021) is one example of many studies that shows successful use of STAI in the South African context.

Sleep diary. This measure is used to record participants sleep patterns: the time they went to bed and woke up; how long they slept; and how long and when they were awake during the night. The sleep diary that we used for the study was the National Sleep Foundation (NSF, 2019) sleep diary (see Appendix 9). Studies by Carla et al. (2015) and Lockley (2002) indicate the validity and the reliability of using sleep diaries, while studies by Rae et al. (2017) and Greeff & Conradie (1998) show that sleep diaries have been used regularly in South Africa.

Student's exam and tests marks. Student's exam and test marks during the pre- and post-test gave an objective method of testing whether students' performance improved or did not improve after the intervention.

Mindfulness based intervention (MBI). The MBI is a type of a meditation whereby one focuses intensely on their senses and feelings in the moment. The MBI protocol used in this study was a 20-minute English audio guided meditation practice tool developed in South Africa. The MBI we used in the study was developed by a local clinical psychologist and used as a meditative practise at the Graduate School of Business at UCT. The instructor asks individuals to be in a sitting position with their eyes open or closed. They then guide the individual to be aware of their breathing. To help individuals remain focused on the exercise, the guide would encourage individuals to acknowledge and accept their thoughts once the mind starts wondering. Everyone completes the last few minutes of the exercise without being guided. According to Bishop et al. (2004) a 20-minute mindfulness practice over 4 days can be helpful to build one's mindful awareness.

Procedure

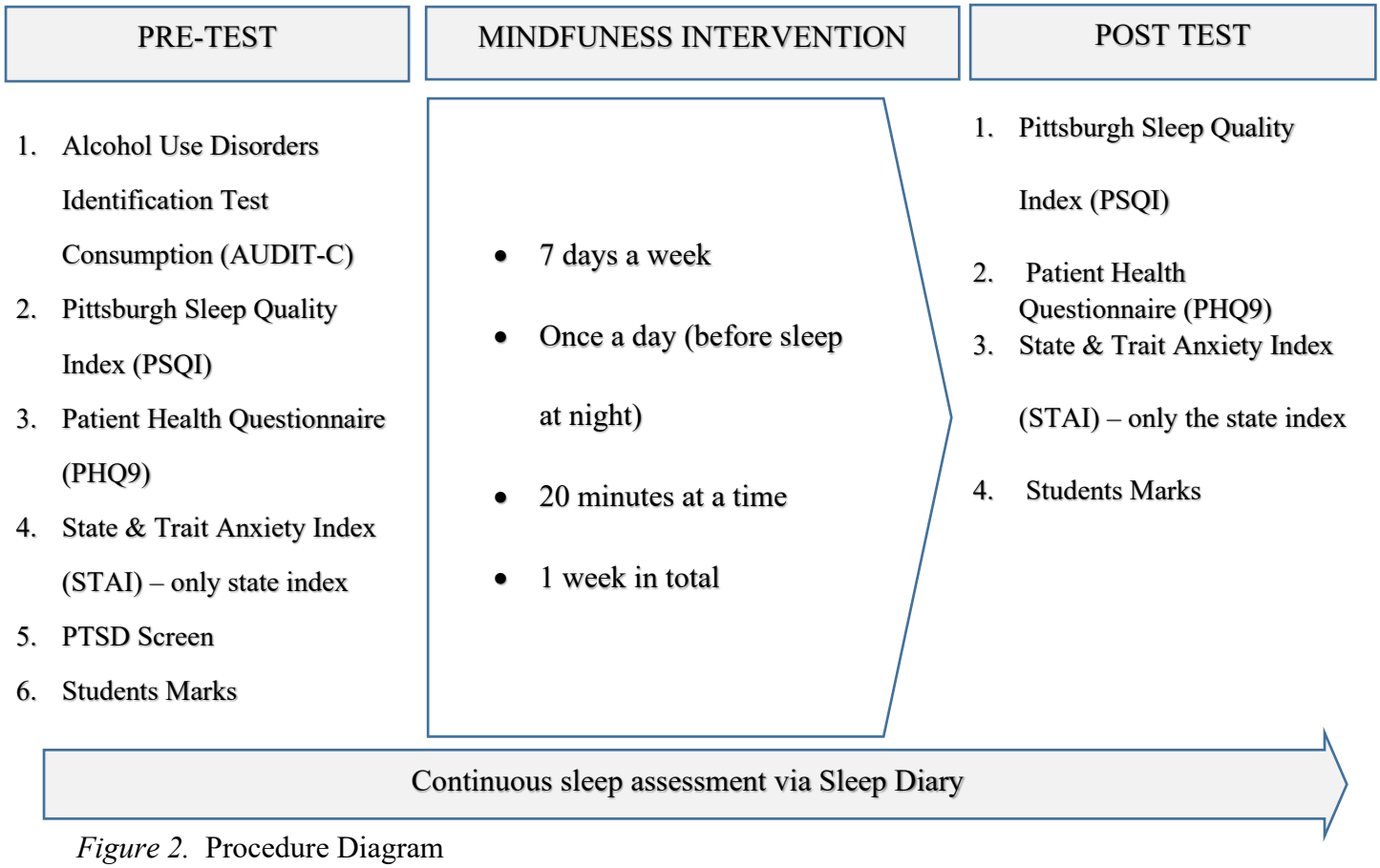

Figure 2. Procedure Diagram

Recruitment, screening, and pre-test measurement phase. The study commenced following clearance from the UCT Ethics Committee. All interested participants completed an online informed consent (Appendix 2: Informed consent), which was followed by online screening for eligible participants using these measures: AUDIT-C, PSQI, PHQ-9, STAI and PC-PTSD. These measures resulted in inclusion/exclusion of participants based on their scores and the PSQI, PHQ-9 and STAI state scores were also recorded as the pre-test outcomes for each participant. For potential participants who scored highly on measures eliciting symptoms of high-risk drinking behaviour, chronic sleep problems, depression, anxiety and post-traumatic stress disorder, an email was individually sent to them to refer them for psychological support through Student Wellness or other free services.

Intervention phase. Eligible participants were divided into two groups (experimental and control group) and two separate briefing sessions were conducted in English at the ACSENT laboratory at UCT Department of Psychology after the screening process was completed. In the briefing session the researcher explained what the study was about. It was conducted a day before the intervention started and was 20 minutes in duration. During the briefing session, the researcher started by explaining the purpose of the session, objectives of the study and the role of the researchers. The researchers also conducted a short training on using the sleep diary daily via Google Forms for both groups. Furthermore, WhatsApp contact details of all participants were collected to send reminders (both morning and afternoon) to remind participants about completing their sleep diaries. Participants in the experimental group received the mindfulness training to prepare them for the intervention, while the control group did not receive this training.

Regarding the intervention, the experimental group received the mindfulness audio via email which they used from their phones and computers. The group was instructed to do the mindfulness exercise using the audio daily every time before they go to sleep for the 7 days duration of the intervention. The intervention group also received a WhatsApp reminder about completing the mindfulness exercise before going to sleep. Both groups were asked to respond to the WhatsApp messages to confirm that they have completed their sleep diaries and intervention group completed mindfulness exercise. The day after the 7-days intervention period, the participants were reassessed using post-test measure (PSQI, PHQ9, STAI (state index) and their test/ exam marks were also noted. The participants pre intervention marks were then compared to their post intervention marks. Only one student's test mark or exam mark was used in pre and post intervention. All the marks obtained were converted to percentages. The difference between the two marks was then use as an indicator to determine academic performance.

Regarding participant remuneration, 38 participants who completed the whole study were entered into a raffle for a chance to win one of three shopping vouchers valued at: R200, R300, and R500. Department of Psychology students who completed the study received 6 students' research participation program (SRPP) points, while those who completed the screening only received 1 students' research participation program (SRPP) points

Data Management and Statistical analyses

Data was analysed with the Statistical Package for Social Sciences version 25 (SPSS® Version 25; IBM Corporation, Armonk, NY, USA). The data garnered from the screening questionnaires and academic performance are presented descriptively. Data was checked for normality of distribution prior to all analyses. Independent sample t-tests were used to compare baseline scores (to see if the two groups were equivalent at the start). The differences between pre- and post-measurement were calculated for each outcome measure (sleep quality, symptoms of depression and anxiety and academic grades). These change variables were analysed using independent sample t-tests to investigate intervention related change. Spearman correlations were used to assess the association between change in sleep duration, the degree to which participants woke up feeling refreshed and the degree to which they were likely to dose in the day, PHQ9, STAI and academic performance (grades) within each group.

Missing data. In the STAI data, two controls were removed as outliers in the pre-STAI because their scores were greater than 3 standard deviations above the mean. In the PHQ9 one intervention person was removed because their score was greater than 3 standard deviations above the mean. In the control group one person had a very high pre-mark (83) and another one had a high post-mark (98), both were removed (as were their change scores). From the intervention group one person had a very large decrease in marks so the change score was removed.

CHAPTER 4

RESULTS

Sample characteristics

Table 4.1 below presents descriptive statistics of the study sample. 18 participants completed the control arm of the study, while 20 participants completed the intervention arm. There were no age-related between group differences (p = .52). Most participants were women (74%), but there were no between-group differences in the proportions of men and women (p = .85).

Regarding clinical characteristics collected via the screening instruments, there were no between-group differences in sleep quality (p = .55), posttraumatic symptoms (p = .97), alcohol use disorder symptoms (p = .94) and trait anxiety (p = .72). Regarding sleep quality, participants in both the control and intervention groups presented with poor sleep quality (M =7.33 and M =7.1 respectively). The ranges for both groups indicated that all participants had some form of sleep disruption (PSQI > 5). Regarding posttraumatic and alcohol use disorder symptoms, all participants met our inclusion criteria and did not present with a clinically significant symptom load (PC-PTSD = 3 or more; AUDIT-C = 5 or more for women and = 7 or more for men).

Regarding baseline characteristics, Table 4.2 shows that there were no between-group differences in participants' sleep duration, freshness upon awakening, likelihood of daytime dozing, symptoms of depression, symptoms of anxiety and marks at baseline. Regarding depressive symptoms, PHQ9 mean scores indicated that both groups presented with mild depression (Control group = 6.78 and Intervention group = 6.70). Regarding symptoms of anxiety participants in both groups had, on average, symptoms of mild anxiety (clinically significant anxiety > 40 on the STAI-S). Regarding sleep duration, participants in our study slept approximately 6 hours per night, which is less than the recommended 7-9 hours for adults (Hirschkowitz et., al, 2021). Regarding participants' responses as to whether they woke up feeling refreshed, participants in both groups indicated that they generally felt somewhat refreshed. Regarding participants' ratings of the chance that they would doze during the day, participants indicated a moderate chance of dozing. Their marks of academic achievement indicate that students in our sample were average learners. The mean scores for control group = 60.56 and intervention group = 68.63).

Table 4.1
Sample and clinical characteristics (N = 38)

	Control Group (n =18)			Intervention Group (n = 20)					
Variables	Mean	SD	Range	Mean	SD	Range	*t*	*p*	Effect size
Age (yrs)	20.00	1.91	18-26	20	1.82	18-25	0.65	.52	< 0.01
Gender: Female: Male	13:5			15:5			-0.19	.85	
PHQ-9	6.78	4.14	0 – 14	6.80	*3.32*	1 – 13	0.02	.99	0.01
PSQI	7.33	1.88	5-11	7.00	1.56	5-10	-0.60	.55	0.19
PC-PTSD	0.39	0.78	0-2	0.40	0.75	0-2	0.05	.97	0.01
AUDIT-C	1.56	1.89	0-6	1.60	1.88	0-6	0.07	.94	0.02
STAI-T	44.28	8.37	30-57	43.25	9.05	25-58	-0.63	.72	0.12

Note. Standard deviations presented in parentheses. Patient Health Questionnaire-9 (PHQ9); Pittsburgh Sleep Quality Index (PSQI); Primary Care Post-Traumatic Stress Disorder Screen (PC-PTSD); Alcohol Use Disorders Identification Test – Consumption (AUDIT – C), State-Trait Anxiety Index (STAI)-T. For gender, chi squared is reported.

Table 4.2

Descriptive statistics: Baseline and post-intervention scores (N = 38)

	Control Group (n=18)		Intervention Group (n=20)				
Variables	Mean	SD	Mean	SD	*t*	*p*	Effect size
Baseline Scores							
Depressive Symptoms	6.78	4.14	6.70	3.34	0.08	.949	0.02
Anxiety Symptoms	42.72	6.08	46.45	6.77	-3.73	.084	0.58
Academic Grades	60.56	7.75	68.63	10.39	-8.07	.059	0.87
Sleep Duration	20.06	95.95	43.22	66.71	-0.87	.389	0.28
Waking Freshness	1.72	0.58	1.85	0.67	-1.28	.535	0.21
Daytime dozing	2.33	0.90	2.40	0.68	-0.67	.798	0.09
Post-intervention Scores							
Post Depressive Symptoms	7.00	5.04	4.32	3.00	1.98	.056	-0.65
Post Anxiety Symptoms	46.50	2.71	47.45	6.20	-0.57	.573	-0.19
Post Academic Grades	58.67	6.02	58.14	14.61	0.10	.920	0.43
Post Sleep Duration	6:53:38	1:26:35	7:06:04	0:58:19	-0.52	.614	-0.17
Post Waking Freshness	2.22	0.73	2.25	0.55	-0.64	.528	-0.21
Post Daytime dozing	1.83	0.71	1.95	0.39	-0.13	.895	-0.43

Note. Sleep duration change is the difference between post-intervention and pre-intervention sleep duration in minutes.

* Denotes mean difference is statistically significant at $p < 0.05$

Hypothesis 1: The influence of mindfulness on sleep quality

There was no statistically significant difference in participants' sleep duration, feelings of energy after sleep or propensity to doze during the following day. However, those in the intervention group slept 23 minutes longer than those in the control group after the study period, although the variation between participants' sleep durations was extremely large (see Table: 4.2).

Hypothesis 2: The influence of mindfulness on symptoms of depression and anxiety

Figure 4.1 and Table 3 shows pre- and post-intervention results for symptoms of depression (PHQ9) and symptoms of anxiety (STAI) between the intervention group and control group. Descriptively, depressive symptoms among participants in the control group increased during the study period, whereas for intervention group, there was a decrease in depressive symptoms. Anxiety-related symptoms also increased in the control group, while they remained similar in the intervention group. Statistically, there was a decrease in depressive symptoms (not anxiety-related symptoms) in the intervention group compared to the control group (see Table: 4.2).

Hypothesis 3: The influence of mindfulness on academic performance

Table 4.2 shows pre- and post-intervention results for academic grades. There was no between-group in participants' academic performance (p = .065).

Table: 4.3

Comparison of Intervention and Control Group changes in mental health, academic performance and sleep quality (N=38)

	Control Group (n=18)		Intervention Group (n=20)				
Variables	Mean	SD	Mean	SD	*T*	*p*	*ESE*
Δ in Depressive Symptoms	0.22	4.07	-2.26	3.57	-2.46	.028*	0.63
Δ in Anxiety Symptoms	3.94	5.41	1.00	9.62	2.49	.142	-0.91
Δ in Academic Grades	-1.50	6.19	-8.83	12.12	2.94	.065	-22.28
Δ in Sleep Duration	20.06	95.95	43.22	66.71	-0.87	.195	7.20
Δ in Waking Freshness	0.17	0.58	0.16	0.83	0.20	.492	0.00
Δ in Daytime Dozing	-0.21	0.93	-0.19	0.67	-0.11	.455	0.01

Note. Sleep duration calculated from pre-intervention sleep duration reported in the PSQI and post-intervention reported sleep duration. *p <.05.

Hypothesis 4 and 5: The relationship between changes in sleep quality and symptoms of depression and anxiety/ academic performance

There were no associations for the entire sample or intervention group between (a) changes in sleep duration, participants feelings of being refreshed on waking, participants propensity to doze in the day, and (b) changes in symptoms of depression and anxiety or academic performance after the intervention period. The only significant associations were demonstrated for the control group. For participants in this group, longer sleep duration after the intervention was moderately associated with decreases in anxiety symptoms. Furthermore, for this group, better academic grades were strongly associated with increases in anxiety symptoms.

Table: 4.4

Correlation Matrix: Associations (Spearman's rho) between mindfulness intervention and control group

	Entire Sample (N = 38)				Mindfulness Intervention (*n* = 20)				Control (*n* = 18)			
	Δ PHQ-9		Δ STAI-S		Δ PHQ-9		Δ STAI-S		Δ PHQ-9		Δ STAI-S	
	r	*p*	*r*	*P*	*R*	*p*	*r*	*p*	*r*	*p*	*r*	*p*
Δ in Sleep Duration	-.10	.54	-.18	.30	.25	.30	.10	.68	-.24	.33	**-.58***	.02
Δ in Waking Freshness	.16	.50	-.05	.77	-.22	.37	-.03	.90	.01	.96	-.11	.68
Δ in Daytime Dozing	-.20	.28	-.14	.43	-.19	.43	-.14	.56	-.22	.38	-.18	.51
Δ in Academic Grades	.10	.68	.22	.36	-.18	.57	.08	.79	.55	.21	**.86***	.01

Note. * Correlation is significant at the 0.05 level (1-tailed)

CHAPTER 5

DISCUSSION

The study evaluated a mindfulness intervention for improving sleep quality, academic performance and mental health (symptoms of depression and anxiety) in university students. We found poor sleep quality generally among university students, however, there was no significant improvement in sleep quality, symptoms of anxiety or academic performance, between control and intervention groups. However, there was a decrease in depressive symptoms in participants who completed the mindfulness intervention. In the control group we noted that sleeping longer was associated with a decrease in anxiety symptoms.

Hypothesis 1: The influence of mindfulness on sleep quality

The findings showed that the mindfulness intervention did not improve sleep duration, restorative feelings after sleep, or the propensity to nap during the day in comparison with the control condition. These results are inconsistent with a study conducted by Hulsherger, Feinholdt and Nubold (2015). In that study, a total of 148 participants were recruited, then divided into an intervention group (n = 67) and control group (n = 73). The intervention group participated in a self-training mindfulness intervention adapted from mindfulness-based cognitive therapy and mindfulness-based stress reduction daily for a period of 10 days. The control group did not receive any intervention, instead, they went to bed according to their regular schedule. Participants receiving the mindfulness intervention, in comparison with controls, showed better sleep quality (as measured by the PSQI) after the duration of the study. Our results are also inconsistent with other literature that suggests mindfulness interventions improve sleep quantity and quality (Baer, 2003; Biegel, 2009; Bootzin & Stevens, 2005; Carlson & Garland, 2005; Cheng et al., 2012; Dvorakova et al., 2017; Howell et al., 2008; Shao & Skarlicki, 2009; Wall, 2005). However, Li, Kee and Lam (2018) showed that mindfulness improved overall sleep quality but not sleep duration. The inconsistency

between our study and these studies may have been due to the short duration of our intervention and small number of participants, which might have negatively impacted the quality of our intervention. Descriptively, participants receiving the intervention slept on average 43 minutes longer after the intervention period, as opposed to 20 minutes after the control condition. However, the variation in the change in sleep duration was large in each condition and likely obscured any between-group differences.

Hypothesis 2a: The influence of mindfulness on symptoms of depression

Our findings showed that the mindfulness intervention resulted in a reduction in depressive symptoms for those in the intervention group in comparison with the control condition. There are conflicting reports regarding the efficacy of mindfulness on symptoms of depression. For example, Langerlof et al. (2017) conducted a systematic review of empirical studies examining mindfulness interventions for common psychiatric disorders. Drawing on 19 studies, they concluded that the empirical evidence was weak for the treatment of depression with mindfulness. However, these views are contrary to another systematic review on mindfulness-based interventions for psychiatric disorders (including depression; Goldberg et al., 2017). This review, drawing on 49 studies on depression out of 171 selected studies, argues that mindfulness reduces depression.

The difference between these two results may be as a result of the number of studies that were included in each systematic reviews: Langerlof et al. (2017) included 19 studies while Goldberg et al. (2017) study recruited a larger pool of 49 studies. The study by Goldberg et al. (2017) included all studies of randomized clinical trials with evidenced based treatments of mindfulness-based interventions for adult patients with psychiatric diagnoses, however the study by Langerlof et al. (2017) was more stringent in selection of studies as it only restricted to clinical trials and randomized clinical trials reported in English medical journals. Even though the study by Langerlof et al. (2017) was more stringent in some

respects, the search included studies of all common psychiatric disorder without being specific to anxiety or depression. Meanwhile the study by Goldberg et al. (2017) categorised studies according to psychiatric disorder categories (anxiety, depression, addictions, etc). Langerlof et al. (2017) missed many papers while Goldberg et al. (2017) caught a broader pool of studies, and hence, their results may be deemed as more reliable.

Regarding student samples, several studies have found that mindfulness does reduce symptoms of depression and anxiety. For example, Dvorakova (2017) evaluated the effectiveness of a mindfulness intervention on promoting the health and well-being of students. A total of 109 students (n = 55 assigned to the intervention group and n = 54 assigned to the control group) were recruited from Pennsylavia University and participated on a randomized control trial study using Learning to Breathe (L2B) program. The L2B is a mindfulness program which was developed to promote successful college transition into the first year of study. The results of the pilot study showed a significant decrease in student's depression, and increased life satisfaction, although intervention associated changes were small in effect.

The second study by Xu (2019) tested whether self-training in mindfulness can improve the mental health of adolescents with mild depression. This study was conducted in a senior secondary school in China for grades 10 and 12. Out of 900 students 89 met the criteria as they showed mild depression based on Beck depression inventory (BDI) with scores between 14 and 19. A total of 36 out of 89 students volunteered to be part of the study. They were then randomly divided into two groups consisting of a self- training group and control group. Participants in the self-training group completed an 8-week mindfulness program for 6 minutes per day while the control group did not do any intervention. The results of the study showed participants in the self-training group had significantly lower depression score than those in the control group post the intervention. This was again

associated with a small effect size. Our findings are congruent with these studies as we found a between-group difference regarding reduced depressive symptoms for those taking the mindfulness intervention in comparison with controls. Our findings were associated with a medium effect size.

Hypothesis 2b: The influence of mindfulness on symptoms of anxiety

Our findings showed that the mindfulness intervention did not reduce anxiety symptoms for the intervention group in comparison with the control condition. As indicated above, the findings from Lagerlof, Lagerlof and Ost (2017) and Toneatto and Nguyen (2007) suggested mindfulness intervention show a weak or no effect in reducing anxiety and depression. Additionally, Strauss, Cavanagh, Oliver and Pettman (2014) suggest that mindfulness interventions do not always show success in reduction of anxiety symptoms. Contrary to these views, a narrative review (Bamber & Schneider, 2016) discussing the success of mindfulness-based meditation to decrease anxiety and stress in college students concluded that this intervention could ameliorate anxiety and stress in college students. This review examined 40 studies that evaluated the use of mindfulness to treat anxiety. 83% of the studies showed significant decreases in anxiety. Apart from the review conducted by Bamber and Schneider (2016), many other studies not included in that review suggest mindfulness does reduce anxiety (Beauchemin, Hutchins & Patterson, 2008; Berghoff et al., 2017; Biegel et al., 2009; Black, Milam & Sussman, 2009; Bodenlos et al., 2013; Carmody & Baer, 2008; Cavanagh et al., 2013; Crowley et al., 2018; Dhanalakshmi, 2019; Franco et al., 2010; Hjeltnes, Binder, Moltu & Dundas, 2015; Hofmann Sawyer, Witt & Oh, 2010; Hozel et al., 2011; Hou, Ng & Wan, 2015; Lier & Diaz, 2010; Palmer & Roger, 2009; Shanok, Reive, Mize & Jones, 2019; Semple et al.,2010; Vesa, Liedberg & Ronnlund, 2016). For example, one study recruiting 125 participants evaluated the effectiveness of mindfulness programs on stress, anxiety and depression in university students. Results indicated a significant reduction

in anxiety among the participants (Gallego et al., 2014). The participants were randomly assigned to three groups, namely a mindfulness group (41 students), a physical education intervention (42 students) and a control group (42 students). The mindfulness group received 8 sessions of intervention on mindfulness based cognitive therapy (MBCT). Each of the sessions took an hour and consisted of body scan, mindfulness breathing, and sitting meditation. The overall results showed that the mindfulness intervention was effective, because the reduction in anxiety and other variables was higher for the mindfulness group than the other two groups.

These results are contrary to our findings. The first factor that can explain this difference is that our sample started with low to moderate symptoms of anxiety and did not have severe symptoms. However, 40 studies reviewed by Bamber & Schneider (2016), and other studies (see e.g. Beauchemin, Hutchins & Patterson, 2008; Biegel et al., 2009; Binder, Moltu & Dundas, 2015; Call, Miron & Orcutt, 2014; Carmody & Baer, 2008; Crowley et al., 2018; Delgado-Pastor et al., 2015; Dhanalakshmi, 2019; Hofmann Sawyer, Witt & Oh, 2010; Semple et al.,2010) generally recruited participants who either had a clinical diagnosis or showed severe symptoms of anxiety prior to the mindfulness intervention. Another factor that may explain the difference in results between our findings and that of the literature is that our mindfulness intervention dose treatment (4 days composed of 20 minutes mindfulness practice) as opposed 5 weeks, 20 minutes daily mindfulness practice may not have been strong enough to cause an effect in the participants' stated anxiety levels.

Hypothesis 3: The influence of mindfulness on academic performance

Our findings showed that the mindfulness intervention did not improve the marks for the intervention group in comparison with the control condition. This is similar to Carsello and Creaser (1978), and Dodds (1975) who found no effect of mindfulness on academic performance. However, numerous studies (Biegel & Brown, 2010; Beuchenimin, Hutchnis &

Patterson, 2008; Binder, Moltu & Dundas, 2015; Durlak et al., 2011; Fiebet & Mead, 1981; Franco et al., 2010; Hall, 1999; Kember, 1985; Leland, 2015; Leon, 2008; Lin & Mai, 2018; Lu, Huang & Rios, 2017; Mrazek et al., 2013; Nidich, et al., 2011) have indicated that mindfulness interventions do improve academic performance. As an example, Lin and Mai (2018) conducted an experiment using first year university students that engaged participants in mindfulness meditation. Participants were randomly divided to experimental group (n=42; receiving mindfulness meditation) and control group (n=35; tasked to review a chapter in a training manual). The duration of the experiment was 3 months and involved a cumulative approximate 2hr per week intervention, consisting of practicing mindfulness meditation for 10 – 20min (basic sitting meditation and breathing) each day. The experiment procedure included two stages, stage one included teaching of 4 lessons over a duration of 4 weeks then performing a summative assessment in week 6 and stage two included teaching additional 3 lessons over duration of 5 weeks then performing summative assessment in week 12. The results showed that mindfulness meditation significantly improved short term academic performance (during the 6 weeks assessment) for the experiment group, but the results were not significantly improved over long-term academic performance (12 weeks). The second study by Franco et al. (2011) also showed that mindfulness intervention does improve academic performance. A total of 61 participants were recruited from three public schools in Spain. The 61 participants were randomly allocated to two groups, control group (n = 30) and experimental group (n = 31). They all completed a self-concept questionnaire which is made up of 36 items that measure academic, social, emotional and family dimensions. The experimental group received a 1h30 minute mindfulness session per week for 10 weeks. The results showed statically significant differences between the groups on all variables including academic performance. Both in Franco et al. (2011) and Lin and Mai (2018) the duration of the experiments was long (10 weeks and 12 weeks respectively). However, in our study the

duration of our intervention may not have been long enough (1 week). We also used two different kinds of assessments – either exam or test marks and there may have been some differences in how students performed on these two different kinds of evaluation that confounded our results.

Hypothesis 4 and 5: The relationship between changes in (a) sleep quality and (b) symptoms of depression and anxiety

Our findings showed that there was no correlational between symptoms of depression or anxiety and sleep duration for those completing the mindfulness intervention. However, for those in the control group, poor sleep quality was associated with increased anxiety symptoms. There was no association between sleep quality and depressive symptoms in this group. One speculation regarding the former significant association is that mindfulness is protective against the negative consequences of poor sleep quality. While control participants with poor sleep quality, were more anxious, those in the intervention group with similar levels of sleep disruption did not experience an associated increase in anxiety. While our findings suggest that mindfulness is protective against sleep disruption, other authors have found that it improves sleep quality. As an example, Black et al. (2021) focused on determining whether mindfulness was effective in improving sleep quality in older adults with moderate sleep disturbances. In this 12-month randomized control trial, one group (n = 24) received mindfulness awareness practices (MAPs) while the other group received sleep hygiene education (n = 25). Both groups received a 6-week intervention of 2 hours per week with assigned homework. The participants in the intervention group showed significant improvement relative to those in the control group on their sleep and secondary health outcomes of insomnia symptoms (depression symptoms, fatigue interference and fatigue severity). The authors concluded that mindfulness could improve sleep quality, sleep related daytime impairment and improve quality of life among older adults with sleep disturbances.

Additional findings.

Our findings showed that participants in the control group who had increased symptoms of anxiety had better academic performance. There was no such association for those completing the mindfulness intervention. The correlation in the control group is in contradiction to several studies including Chapell et al. (2005); DordiNejad et al. (2011); Junaid et al. (2020). As an example, the study by DordiNejad et al. (2011) examined 150 medical students' anxiety before, during and after taking a university-level test. The results revealed that test anxiety has a negative effect on student academic performance. In another study, Junaid et al. (2020) investigated the relationship between anxiety and academic performance over a six-month period. The results revealed an association between high anxiety and getting low grades among the students. Our correlation finding in the control group are however consistent with studies by Balogun et al. (2017). The focus of this study was to investigate the relationship between achievement motivation, test anxiety and academic performance. The study recruited students from a public university in Ondo State, Nigeria (n = 393) made up of 192 males and 201 females. The study acknowledged that high anxiety could result into poor academic performance amongst the students, however concluded that in their sample high achievement motivation and high anxiety resulted in positive academic achievement.

Lastly the difference between the control group and mindfulness group may have resulted from the intervention somewhat lowering anxiety in the intervention group (even if not statistically significant), as such the participants were not as worried about their grades and speculatively may not have studied as hard.

Limitations

The current study had several limitations which should be addressed by researchers in future studies evaluating mindfulness intervention on the mental health of university students.

The first limitation of this study was the limited sample size, which may have obscured underlying intervention-based improvements in sleep and mental health outcomes. The second limitation of this study was the recruitment criteria, since it excluded candidates with severe depression and elevated anxiety symptoms. In the studies of mindfulness intervention for anxiety and depression above, participants with both diagnoses of depression and elevated anxiety symptoms for were recruited. In our study we may not have seen changes in depression and anxiety because participants had already shown low levels of both depression and anxiety. Because of the reported low levels of symptoms, we may have needed a stronger intervention to induce intervention-related changes. The third limitation of the study was the intensity/ dose and length of the intervention. The 20 minutes intervention a day of mindfulness intervention over 7 days made the intervention short and less intense, hence the dose may have been too mild to improve grades and depressive and anxiety-related symptoms. The fourth limitation is failure to monitor if the participants indeed managed to do their mindfulness exercise daily for 20 minutes for the duration of seven days. Some participants possibly did not do the intervention for the full 20 minutes duration and/or the 7-day period. The fifth limitation has to do with the online assessment forms - the pre- and post-questionnaires were online, and participants could fill the forms at their own place and time. Participants may have unintentionally given incorrect answers when they did not understand the items or may have given socially accepted answers.

CONCLUSION

In conclusion, our results indicate that there is no relationship between mindfulness and sleep quality, however the mindfulness intervention reduced symptoms of depression in the intervention group. Future studies should investigate the associations between mindfulness, sleep quality and mental health outcomes in students, who experience a high burden of mental health difficulties. Additionally, future studies can investigate the possibility of mindfulness intervention as a confounding factor that led to null sleep findings. These studies could address the validity of selected intervention method. Lastly, future studies can investigate trait mindfulness (as a psychological phenomenon) and its relationship with mindfulness and mental health problems.

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Appendix 1

SRPP Advertisement

Dear all,

You are invited to participate in a sleep intervention study.

What is this study about? The aim of this study is to evaluate mindfulness as an intervention for sleep challenges in university students.

What will I be asked to do if I agree to participate? You will be asked to answer a questionnaire before the intervention, and again after the intervention. The questionnaire will take approximately 40 minutes and will be in English. Participants selected to participate in the intervention will be asked to complete 20-minute mindfulness exercises for 1-week. At the end of this week all participants will be asked to complete a questionnaire.

Would my participation in this study be kept confidential? All participants' identities and any information you disclose will be kept confidential.

What are the benefits of this research? Those who participate in the study will get 6 SRPP points for next semester. You might have better sleep, and reduced stress, if the intervention is effective.

Inclusion criteria:

- Between 18 - 40 years of age

Exclusion criteria:

- Have no neurological disorders known to affect sleep or history of psychosis
- Current psycho-active drug use
- A history of psychosis
- Are currently experiencing severe depressive, anxiety or post-traumatic stress disorder symptoms

Please follow the link below

Appendix 2

DSA Advertisement

Dear student,

You are invited to participate in a sleep intervention study. The main aim of this study is to evaluate mindfulness as an intervention for sleep challenges in university students.

Inclusion criteria:

- Between 18-40 years of age

Exclusion criteria:

- Have any neurological disorders known to affect sleep or mental health outcomes
- Current psycho-active drug use
- A history of psychosis
- Are currently experiencing severe depressive, anxiety, or post-traumatic stress disorder symptoms

To participate you will need to complete a screening questionnaire and should you meet the eligibility criteria you will be invited via email to participate in the study. Completing the questionnaire does not guarantee you a place in the study. The questionnaire will take approximately 40 minutes. All selected participants will be asked to attend a 20-minute briefing session. Participants selected to be in the intervention will be asked to complete daily 20-minute mindfulness exercises at-home for 1-week. All participants will be asked to keep a sleep diary for the duration of the study (i.e., a week).

Some questions are of a personal nature, and might make you feel uncomfortable, for instance questions about your mental health. Participants' identities and any information disclosed will be kept confidential. Ethical approval has been granted.

If you complete this study, you will be entered into a raffle for a chance to win one of three Cavendish vouchers valued at: R200, R300, and R500.

If you are interested in participating in this study, follow the link below to complete the questionnaire:

Appendix 3

Demographic Information

First Name (Optional):

Last Name (Optional):

Telephone Number (Optional):

Email (Optional):

Student Number (Required):

Course Code (Required):

Date of Birth (Required):

Gender (Required):

- Male
- Female
- Other
- Prefer not to say

Highest Level of Education (Required):

- High School Graduate
- National Certificate or National Diploma
- Bachelor's Degree or Higher Diploma
- Honours Degree or Post Graduate Certificate
- Masters Degree
- Doctors Degree

Primary Language (Optional):

In the last three months, how often have you seen a healthcare provider for physical or mental health issues? (Optional):

Do you have any chronic medical conditions? Please specify below (Optional)

Are you currently diagnosed with a mental health condition? Please specify below (Optional)

Appendix 4

Pittsburgh Sleep Quality Index

During the past month: When have you usually gone to bed?

During the past month: How long has it taken you to fall asleep each night?

During the past month: When have you usually gotten up in the morning?

How many hours of actual sleep do you get at night?

The following questions relate to your usual sleep habits during the past month only. Your answers should indicate the most accurate reply for the majority of days and nights in the past month. Possible answers: (1) Not during the past month; (2) Less than once a week; (3) Once or twice a week; (4) Three or more times a week.

During the past month:

- I cannot get back to sleep within 30 minutes
- Wake up in the middle of the night or early morning
- I have to get up to use the bathroom
- I cannot breathe comfortably
- I cough or snore loudly
- I feel too cold
- I feel too hot
- I have bad dreams
- I have pain
- Other reason(s), how often do you have trouble sleeping because of this reason(s)
- How often have you taken medicine (prescribed or "over the counter") to help you sleep?
- How often have you had trouble staying awake while driving, eating meals, or engaging in social activity?
- How much of a problem has it been for you to keep up enthusiasm to get things done?

During the past month, how would you rate your sleep quality overall? *

- Very good
- Fairly good
- Fairly bad
- Very bad

Appendix 5

State-Trait Anxiety Index

State Anxiety:

A number of statements which people have used to describe themselves are given below. Read each statement and then select the appropriate number to the right of the statement to indicate how you feel right now, that is, at this moment. There are no right or wrong answers. Do not spend too much time on any one statement but given the answer which seems to describe your present feelings best.

Possible answers: (1) Not at all; (2) Somewhat; (3) Moderately so; (4) Very much so.

1. I feel calm.
2. I feel secure.
3. I am tense.
4. I feel strained.
5. I feel at ease.
6. I feel upset.
7. I am presently worrying over possible misfortunes.
8. I feel satisfied.
9. I feel frightened.
10. I feel comfortable.
11. I feel self-confident.
12. I feel nervous.
13. I am jittery.
14. I feel indecisive.
15. I am relaxed.
16. I feel content.
17. I am worried.
18. I feel confused.
19. I feel steady.
20. I feel pleasant.

Trait Anxiety:

A number of statements which people have used to describe themselves are given below. Read each statement and then select the appropriate choice to the right of the statement to indicate how you generally feel. There are no right or wrong answers. Do not spend too much time on any one statement but given the answer which seems to describe how you generally feel.

Possible answers: (1) Almost never; (2) Sometimes; (3) Often; (4) Almost always.

1. I feel pleasant
2. I feel nervous and restless
3. I feel satisfied with myself
4. I wish I could be as happy as others seem to be
5. I feel like a failure
6. I feel rested
7. I am "calm, cool, and collected"
8. I feel that difficulties are piling up so that I cannot overcome them
9. I worry too much over something that really does not matter
10. I am happy
11. I have disturbing thoughts
12. I lack self-confidence
13. I feel secure
14. I make decisions easily
15. I feel inadequate
16. I am content
17. Some unimportant thought runs through my mind and bothers me
18. I take disappointments so keenly that I cannot put them out my mind
19. I am a steady person
20. I get in a state of tension or turmoil as I think over my recent concerns and interests

Appendix 6

Patient Health Questionnaire-9

Over the past 2 weeks, how often you been bothered by any of the following problems?

Possible answers: (1) Not at all; (2) Several days; (3) More than half the days; (4) Nearly every day.

1. Little interest or pleasure in doing things.
2. Feeling down, depressed, or hopeless.
3. Trouble falling asleep, staying asleep, or sleeping too much.
4. Feeling tired or having little energy.
5. Poor appetite or overeating.
6. Feeling bad about yourself - or that you are a failure or have let yourself or your family down.
7. Trouble concentrating on things, such as reading the newspaper or watching television.
8. Moving or speaking so slowly that other people could noticed. Or the opposite - being so fidgety or restless that you have been moving around a lot more than usual.
9. Thoughts that you would be better off dead or of hurting yourself in some way.

Appendix 7

Primary Care Post-Traumatic Stress Disorder Screen

Sometimes things happen to people that are unusually or especially frightening, horrible, or traumatic. For example: a serious accident or fire; a physical or sexual assault or abuse; an earthquake or flood; a war; seeing someone be killed or seriously injured; having a loved one die through homicide or suicide.

Have you ever experienced this kind of event? Yes No

In the past month, have you:	Yes	No
Had nightmares about the event(s) or thought about the event(s) when you did not want to?		
Tried hard not to think about the event(s) or went out of your way to avoid situations that reminded you of the event(s)		
Been constantly on guard, watchful, or easily startled?		
Felt numb or detached from people, activities, or your surroundings?		
Felt guilty or unable to stop blaming yourself or others for the event(s) or any problems the event(s) may have caused		

Appendix 8

Alcohol Use Disorders Identification Test – Consumption

How often do you have a drink containing alcohol?

- Never
- Monthly or less
- 2-4 times a month
- 2-3 times a week
- 4 or more times a week

How many standard drinks containing alcohol do you have on a typical day when you are drinking?

- 0
- 1 or 2
- 3 or 4
- 5 or 6
- 7 to 9
- 10 or more

How often do you have six or more drinks on one occasion?

- Never
- Less than monthly
- Monthly
- Weekly
- Daily or almost daily

Appendix 9

Sleep Diary

Day of week (e.g., Monday, Tuesday):

I went to bed last night at:

I got out of bed this morning at:

Last night I fell asleep:

- Easily
- After some time
- With difficulty

How many times did you wake up during the night?

How long were you awake during the night?

Last night I slept a total of:

My sleep was disturbed by:

When I woke up for the day, I felt:

- Refreshed
- Somewhat refreshed
- Fatigued

How many caffeinated drinks did you consume in the morning?

How many caffeinated drinks did you consume in the afternoon?

How many caffeinated drinks did you consume in the evening?

I exercised at least 20 minutes in the:

- Morning
- Afternoon
- Evening
- Not applicable

Took a nap?

- Yes
- No

How long was the nap?

During the day, how likely was I to doze off while performing daily activities:

- No chance

- Slight chance
- Moderate chance
- High chance

Approximately 2-3 hours before going to bed, I consumed:

- Alcohol
- A heavy meal
- Caffeine
- Not applicable

In the hour before going to sleep, my bedtime routine included:

Appendix 10

Informed Consent Form

Project Title: Evaluating a mindfulness intervention for improving sleep and mental health in university students

What is this study about?

The aim of this study is to evaluate mindfulness as an intervention for sleep challenges in university students. This study is being conducted by Theophilus Oldjohn and Candice Knipe, from the Department of Psychology at UCT as partial fulfilment of the MA in Clinical Psychology Degree and Honours Psychology, respectively.

What will I be asked to do if I agree to participate?

You will be asked to answer a questionnaire before and after the intervention. You will be assigned either to receive the intervention, or not. Whether you receive the intervention or not, you will be asked to answer the questionnaire. The questionnaire will take about 30 minutes and will be in English. The whole study will take 1 week, with daily 20-minute exercises for those who receive the intervention. If you are willing, we will also ask you to disclose your exam marks.

What are the risks of this research?

There are no known risks for participating in this study.

What are the benefits of this research?

You will receive 6 SRPP points and may have improved sleep quality and duration; aside from this there are no direct benefits.

Would my participation in this study be kept confidential?

All the participants' identities and any information you disclose will be kept confidential.

Participation is Voluntary

Your participation in this research is completely voluntary. You may stop participating in this study at any stage. If you decide not to participate in this study or if you stop participating at any time, there will be no effect on your studies or relationship with the Department of Psychology. Please note, that you will only be entitled to the SRPP points upon completion of the study.

What if I have questions?

If you have any questions about the research study itself, please contact:

Theophilus Oldjohn

UCT - Child Guidance Clinic

Chapel Road

Rosebank

7700

South Africa

Tel: 081 3582781

Email: oldjohnt@gmail.com

Candice Knipe

Tel: 071 413 7758

Email: candice.knipe7@gmail.com

Should you have any questions regarding this study and your rights as a research participant or wish to report any problems you have experienced related to the study, please contact:

Supervisor: Dr Gosia Lipinska

UCT Sleep Sciences and Clinical Neuropsychology

Department of Psychology

University of Cape Town

Tel: 021 640 3415

Co- Supervisor: Michelle Henry

Room 5.04 Hoerikwaggo Building

Tel: (021) 650 – 1804

Alternatively contact directly:

Ethics Secretary: Rosalind Adams

P.D. Hahn Psychology Building

Chemistry Road

University of Cape Town

Rondebosch

Cape Town

7701

Tel: +27 21 650 3417

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Appendix 11

Debriefing Form

Project Title: Evaluating a mindfulness intervention for improving sleep and mental health in university students

Thank you for participating in this research study.

What was the purpose of this research study?

The aim was to investigate whether mindfulness practices would improve sleep quality and duration which subsequently would enhance resilience.

What was done during this research study?

Students were invited to complete an assessment which was both a screening and pre-test measure. Eligible participants were pseudorandomly assigned to either the intervention or control group. The intervention group were tasked with daily 20-minute mindfulness practices for a week. The intervention was provided in a guided awareness of breath audio. Both groups were required to record their sleep data via sleep diaries and, for some, Fitbits during this week. At the end of the week, all participants were asked to complete the assessment again as a post-test.

If the intervention is found to be effective, participants who part the control group will be provided with the intervention as well.

Should you have any questions regarding this study or wish to report any problems you have experienced related to this study, please contact the researchers or their supervisors:

Researcher: Theophilus Oldjohn

Tel: 081 3582781

Email: oldjohnt@gmail.com

Researcher: Candice Knipe

Tel: 071 413 7758

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Supervisor: Dr Gosia Lipinska

Tel: 021 640 3415

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Co- Supervisor: Michelle Henry

Tel: 021 650 1804

Email: mhmish@gmail.com

Alternatively contact directly:

Ethics Secretary: Rosalind Adams

Tel: 021 650 3417

Email: rosalind.adams@uct.ac.za

Appendix 12

Ethical Approval

UNIVERSITY OF CAPE TOWN

Department of Psychology

University of Cape Town Rondebosch 7701 South Africa
Telephone (021) 650 3417
Fax No. (021) 650 4104

30 April 2019

Theo Oldjohn
Department of Psychology
University of Cape Town
Rondebosch 7701

Dear Theo

I am pleased to inform you that ethical clearance has been given by an Ethics Review Committee of the Faculty of Humanities for your study, Evaluating a mindfulness intervention for improving sleep and mental health in University students. The reference number is PSY2019-016.

I wish you all the best for your study.

Yours sincerely

Signed by candidate

Lauren Wild (PhD)
Associate Professor
Chair: Ethics Review Committee

University of Cape Town
ΨPSYCHOLOGY DEPARTMENT
Upper Campus
Rondebosch