THE EFFECTOF A HOMOEOPATHIC COMPLEX REMEDY, (*Argentum nitricum* 200 CH, *Kalium phosphoricum* 200 CH and *Gelsemium sempervirens* 200 CH), on perceived levels of anxiety and cortisol levels in students

A mini-dissertation submitted to the faculty of Health Sciences, Technikon Witwatersrand, Johannesburg, in partial fulfilment of the requirements for the degree of Master of Technology: Homoeopathy

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DECLARATION

I declare that this Dissertation is my own, unaided work. It is being submitted for the Degree of Master of Technology at the Technikon Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination in any Technikon or University.

_____
(Signature of Candidate)

1st day of December

ABSTRACT

This study was conducted in order to determine the effect of the homoeopathic complex consisting of *Argentum nitricum* 200CH, *Kalium phosphoricum* 200CH and *Gelsemium sempervirens* 200CH on cortisol hormone and perceived levels of anxiety in students. It was hypothesized that the complex remedy would decrease the students' perceived levels of anxiety and thereby decrease the students 24-hour cortisol levels. It was hoped that if this proved to be the case, the complex remedy could be used to treat anxiety and other conditions in which cortisol levels are high, for example, Cushing's syndrome.

This was a fully randomized double blind, placebo-controlled study. Twenty volunteers who reported suffering from test anxiety participated in this study. Ten of these volunteers formed part of the control group and the other ten formed part of the experimental group. The control group received placebos to take which were exactly the same in look and taste to the actual remedy given to the experimental group. Volunteers who participated in the study were all in the same year and course of study and thus were experiencing relatively equal amounts of stress, social pressure and academic demand.

The study involved an anxiety-free and an anxiety-inducing situation. In the anxiety-free portion of the study, volunteers were required to collect their urine over a 24-hour period to establish their 24-hour urine cortisol baseline/normal levels. They were also required to complete the State-Trait Anxiety Inventory (a psychological test designed to differentiate between general feeling of anxiety/trait anxiety and feelings of anxiety in an anxiety-induced situation/state anxiety) simultaneously to establish their anxiety levels in a normal, non-anxiety-inducing situation. This was conducted and scored by a registered psychologist. In the anxiety-inducing portion of the study, the students were given their remedy complex or placebo to take 24-hours before a test/anxiety-inducing

situation. On the day of the test, the students were once again required to collect their urine for a 24-hour urine cortisol level. They were also required to complete the State-Trait Anxiety Inventory once again, twenty minutes before their test. In order to measure the 24-hour cortisol levels, an independent pathology laboratory used the Beckman Access® Test to measure the cortisol levels for both the pre-and post tests. The pre-test was performed on 13 February 2002 and the post-test on 8 May 2002.

Numerical data was collected and statistically analyzed using the Wilcoxon matched pairs test.

The experimental group had an increase of 5,76% in State anxiety and the control group had a 6,31% decrease in State anxiety.

The experimental group had a 2,75% decrease in Trait anxiety and the control group had an 8,41% decrease in Trait anxiety.

The experimental group had a 59,17% increase in 24-hour cortisol levels and the control group had an increase of 494,18%.

Thus, the complex did prevent a dramatic increase in cortisol levels but did not significantly alter State or Trait Anxiety.

DEDICATION

To my parents Gavin and Marguerite Thomson for all their love and support

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CHAPTER ONE

INTRODUCTION

1.1 PROBLEM STATEMENT

Anxiety is an emotion experienced by all individuals at one time or another during their lives. Anxiety in moderation has an adaptive effect and prevents individuals from injuring themselves. Anxiety only becomes problematic when it inhibits an individual from living a happy and fulfilled life by impacting on the individual's social and work environment (Gilbert, 2001: 723-751; Ninan, 2001: 5-10 & Purdon *et al.,* 2001: 203-215). Anxiety is also responsible for poor test and exam performance. When an individual experiences anxiety, cortisol, a stress hormone, levels are raised and extended periods of high cortisol levels are responsible for conditions such as Cushing's syndrome. Cushing's syndrome affects most systems of the body and the individual may present with a moon face, acne and hirsutism, trunk obesity with striae, peptic ulceration, hypertension and diabetes and psychiatric disturbances (Stevens & Lowe, 1995: 310). Other complications of elevated cortisol levels are lowered immunity as well as poor memory and attention (Heffelfinger & Newcomer, 2001: 491-513 & Newcomer *et al.,* 1994: 2047-2053).

1.2 HYPOTHESIS

It is hypothesized that the administration of the homoeopathically prepared complex consisting of *Argentum nitricum* 200CH, *Kalium phosphoricum* 200CH and *Gelsemium sempervirens* 200CH will significantly reduce perceived levels of anxiety and thus reduce cortisol levels.

1.3 PURPOSE OF STUDY

The purpose of this study is to reduce cortisol hormone levels by reducing perceived levels of anxiety. Activation of the Hypothalamic-Pituitary Axis (HPA) occurs non-specifically in response to internal and external stimuli. These stimuli include novelty, predictability, controllability, anticipation of negative consequences and ego-involvement (Pruessner *et al.*, 1997, 615-616). Thus anxiety, a symptom of stress, or even an individual's perceived anxiety can trigger the body to release cortisol (stress hormone). Cortisol is responsible for feelings of nervousness and for the somatic symptoms of anxiety such as breathlessness, sleeplessness, diarrhoea and nausea. High cortisol levels are also linked to poor memory and test performance and systemic disorders such as Cushing's syndrome. By reducing perceived levels of anxiety it is hoped that cortisol levels will be reduced. This may subsequently improve volunteers' memory and test performance.

1.4 IMPORTANCE OF PROBLEM

Most individuals suffer from anxiety at one point or another in their lives. However, for some the anxiety is so debilitating that it impacts on them physically, emotionally, academically and socially. Anxiety is linked to increased absenteeism, poor job or academic performance, large medical bills for companies and the anxious individuals and in extreme circumstances may lead to metabolic disorders and decreased immunity and thus more sick leave (Gilbert, 2001: 723-751; Ninan, 2001: 5-10 & Purdon *et al.*, 2001: 203-215).

If anxiety and thus cortisol hormone levels are reduced then work and academic performance may improve, absenteeism can be reduced and metabolic disorders and illnesses arising from poor immunity may be tempered.

CHAPTER TWO

REVIEW OF LITERATURE

2.1 Anxiety

Anxiety manifests in one of three ways:

- Behaviourally by a person's actions, including avoidance behaviour;
- Cognitively in a person's thoughts and ideas, including fear of catastrophe, dying or suffocation;
- Somatically in a person's psychological or biological reactions, including shallow breathing, heart palpitations, increased perspiration, fainting, elevated blood pressure, diarrhoea and muscular tenseness (Sue *et al.*, 1994: 162-163).

An individual experiencing stress usually experiences a sense of bewilderment, anxiety, anger, depression, over activity and/or withdrawal (Lloyd, 1999: 1087). Anxiety is the main undesirable symptom of stress (www.medlineplus.com, 2000) and is a universal experience which only takes on medical significance if it is disproportionate to the external events or if it persists for a long period of time after the precipitating factors have been resolved (Lloyd, 1999: 1087). An individual suffering from anxiety may experience apprehension, a fear of impending disaster, irritability and depersonalization on a psychological level. On a somatic level they may experience trembling, sweating, palpitations, chest pain, breathlessness, headaches, dizziness, diarrhoea, frequency of micturition, insomnia and/or poor concentration (Lloyd, 1999: 1088). However, it is important to consider that anxiety is part of the human experience and is experienced by everyone in moderation when it has an adaptive response. For example, anxiety is responsible for individuals

going for medical checkups and studying for exams and thus aids the individual in leading a longer and more productive life (Bootzin *et al.,* 1993: 158).

2.1.1 Anxiety and Test Performance

Students commonly experience feelings of anxiety, nervousness and poor concentration during examinations and tests. These feelings may often result in failure, a loss of self-confidence and may waste valuable time and money for the student. This in turn, impacts on a societal level resulting in health care utilization and added burdens on the community (Ninan, 2001: 5-10 & Traub, 2000: 5).

Anxiety may be situation specific (state anxiety) and/ or may be due to a predisposition of an individual to view certain generally normal situations as threatening (trait anxiety). Individuals who suffer from anxiety be it state or trait or both forms of anxiety together tend to perform poorly in relation to their peers (Smith *et al.,* 2001: 275-284). This poor performance may result in a vicious cycle where failing an important examination not only results in feelings of failure, humiliation and anger but also results in feelings of despondency and lack of confidence. This in turn also results in poor performance and depression (Ralph and Mineka, 1998: 204). However, these depressive feelings only occur when the individual becomes pessimistic (Metalsky *et al.,* 1993: 101-109).

2.1.2 Factors Affecting Anxiety

There are several factors that play a role in increased anxiety and these include:

- Gender: women tend to experience anxiety more than men (Pamphlett & Farnill, 1995: 297-302).
- Students with high anxiety levels: These students tend to direct their attention towards examination related words such as test and failure and tend to be better at remembering threatening words (Reidy & Richards, 1997: 531). Thus, their attention is directed away from constructive study, interfering with concentration and may result in unnecessary nervous energy. Highly anxious students are also more inclined to physiological changes as a result of anxiety (Dibartolo *et al.*, 1997: 1011-1111).
- Low self-esteem: Low self-esteem is related to high levels of anxiety and results in poor concentration and memory. However, these individuals tend to do well in exam situations, as they desire to have control over the situation (Clow & Hucklebridge, 2001: 5-17 & Traub 2000: 13-15). Individuals who view themselves as separate from their peer or social group tend to have poorer memories in an anxiety-inducing situation than those individuals who have a positive self-image (Coles *et al.*, 2000: 651-665).
- Ego-resiliency: This is the dynamic capacity of an individual to modify his/her modal level of ego-control (individual's threshold for the containment of impulses, feelings and desires), in either direction, as a function of the demands of the environmental context. That is, the individual's ability to be resourcefully adaptive and to be flexible in their available repertoire of problem-solving strategies. Thus poor ego-resiliency is the inability of the ego to restore emotional equilibrium. Individuals with high ego-resiliency show more flexible adaptation than individuals with low ego-resiliency, both on an emotional and psychological level. High ego-resiliency individuals exhibit lower psychological and emotional reactivity (Spangler, 1997: 423-441).

2.1.3 State and Trait Anxiety

Individuals experience different personality states and emotional reactions are usually considered to be an expression of personality states. Emotional states may manifest at any moment in time and may be of differing intensity. Anxiety states are regarded to be subjective experiences, which induce feelings of tension, nervousness and worry and may activate the autonomic nervous system (Spielberger, 1983: 4).

Trait anxiety is considered to be the proneness of an individual to experience a particular situation as dangerous or threatening and thus causes the individual to elevate the intensity of their state anxiety. Thus, trait anxiety is the difference amongst individuals in their disposition to respond to stressful situations with varying amounts of state anxiety. However, it is difficult to determine whether or not individuals who differ in trait anxiety will show corresponding differences in state anxiety. Although, it does depend largely on the extent to which each individual perceives a specific situation to be dangerous or a psychological threat. This perception is predominantly based on the individual's past experience (Spielberger, 1983: 5).

2.1.4 The State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI) consists of separate self-report scales for measuring state and trait anxiety. The State (S)-Anxiety scale consists of twenty statements that evaluate how the individual being tested is feeling at the particular moment of filling in the scale. The Trait (T)-Anxiety scale also consists of twenty statements to test how the individual being tested feels generally (Spielberger, 1983: 6).

2.2 Cortisol

Cortisol is the major glucocorticoid in humans. Cortisol is produced and secreted from the *zona fasiculata* of the adrenal cortex (Brook & Marshall, 1998: 70).

Any physical or neurogenic stress on the body will cause an immediate increase in ACTH secretion by the anterior pituitary gland. This, in turn, results in an increase in the secretion of cortisol from the adrenal cortex. The release of cortisol in stressful situations is believed to be beneficial as cortisol causes rapid mobilization of fats and amino acids from their cellular stores, making them available for energy and the production of compounds such as glucose (Guyton & Hall, 1996: 963-964).

Elevation of cortisol levels also results in increased carbohydrate metabolism, immunomodulation and cardiovascular regulation, which protect vital metabolic functions at the expense of others. An example of this is the maintenance of cerebral glucose supply during starvation. High cortisol levels also prevent potentially damaging inflammatory responses to infection and injury and also prevent organ rejection in transplant operations (Edwards *et al.,* 1999: 580).

High cortisol levels although beneficial when released and sustained over a short period of time, may result in Cushing's syndrome, memory-, immune-and/or performance problems if a person experiences extended periods of high cortisol hormone levels.

2.2.1 Regulation of Cortisol Secretion

2.2.1.1 The Hypothalamic-Pituitary Axis

- **The Hypothalamus**

The hypothalamus is considered to be the most significant gland in the body. It is the pathway that directs input to the pituitary gland. It also receives input from virtually the entire Central Nervous System (CNS) (Beers *et al.,* 1999: 1055). Thus, the hypothalamus is the centre for the collection of all information concerned with the maintenance of a healthy body; including controlling of the pituitary gland (Guyton & Hall, 1996: 935).

- **The Pituitary Gland**

The pituitary gland lies in the *sella turcica*, a small concave bone in the base of the brain. The pituitary gland is connected to the hypothalamus by the pituitary stalk (Guyton & Hall, 1996: 933).
The pituitary gland is separated into two parts-the anterior and posterior pituitary gland (Fox, 1999: 299).

The anterior pituitary gland is responsible for the release of six different hormones, namely:

- growth hormone (GH)
- adrenocorticotropin (ACTH)
- thyroid-stimulating hormone (TSH)
- prolactin
- follicle-stimulating hormone (FSH)
- luteinizing hormone (LH)

All of these anterior pituitary gland hormones are involved in metabolic functions throughout the body (Fox, 1999: 300 & Guyton and Hall, 1996: 933).

The posterior pituitary gland secretes:
- antidiuretic hormone (ADH)
- oxytocin

The first is responsible for water extraction in urine and the second aids in uterine contractions and lactation (Guyton & Hall, 1996: 933 & Fox, 1999: 300-301).

2.2.2 Hypothalamic Control of the Secretion of ACTH from the Anterior Pituitary Gland

Activation of the hypothalamic-pituitary-adrenal (HPA) axis occurs in response to internal and external stimuli (Pruessner *et al.,* 1997: 616), such as malnutrition and trauma (Sue *et al.,* 162). Certain situational characteristics may lead to the activation of the HPA axis. These include novelty, predictability, controllability and anticipation of negative consequences and ego involvement (Pruessner *et al.,* 1997: 616). Psychological variables in adrenocortical stress response include the quality of emotional reactions, effectiveness of psychological defenses and the acute or chronic nature of the threat or stressor. Successful coping skills result in lower adrenocortical responses to stress, while unsuccessful coping is associated with feelings of hopelessness and helplessness resulting in higher adrenocortical activity. Denial as a coping mechanism has been found to increase adrenocortical activity (Pruessner *et al.,* 1997: 616).

Physiologically, secretion of corticotropin-releasing factor (CRF) from the hypothalamus initiates the activation of the Hypothalamic-Pituitary Axis (HPA). CRF is secreted into the main capillary plexus of the pituitary

portal system and is then transported to the anterior pituitary gland where it induces ACTH secretion (Beers, 1999: 1057).

The anterior pituitary gland is capable of secreting only minuscule amounts of ACTH in the absence of CRF. Thus, most conditions that result in high levels of ACTH initiate the secretion of ACTH by stimulating the hypothalamus to secrete CRF (Guyton & Hall, 1996: 965). ACTH then stimulates the adrenal cortex to secrete cortisol (stress hormone) and several androgens (male sex hormones). If there is no ACTH, the adrenal cortex atrophies and cortisol secretion all but ceases (Beers, 1999: 1057).

The adrenocortical cells secrete cortisol. ACTH stimulates the activation of adenyl cyclase that causes the formation of cyclic adenosine monophosphate (Camp) in the cell cytoplasm. Camp then activates the intracellular enzymes that cause the formation adrenocortical hormones including cortisol (Guyton & Hall, 1996: 966).

Simultaneously, cortisol has negative feedback effects on both the hypothalamus and the anterior pituitary gland helping to decrease the formation of CRF and ACTH, respectively. Both these feedback mechanisms help to control plasma concentrations of cortisol (Fox, 1999: 303 & Guyton & Hall, 1996: 966).

2.2.3 Cortisol and Memory

The concept of memory is difficult to define exactly and this may only be addressed from a physiological point of view.

Memories are caused by changes in the capability of synaptic transmission from one neuron to the next as a direct result of previous neuronal activity. These changes allow the development of new

pathways (memory traces) for the transmission of signals through the neuronal circuits of the brain (Guyton & Hall, 1996: 743).

Memories may be classified into three general categories. These are:

- Short-term memory: those memories, which only last from a few seconds up to a few minutes.
- Intermediate long-term memory: memories, which last from a few days to a few weeks but eventually are forgotten.
- Long-term memory: stored memories, which can be recalled years after the memory was formed (Guyton & Hall, 1996: 743).

Memory may also be divided into:

- Declarative memory, which refers to the conscious or voluntary recollection of learned information and
- Non-declarative memory, which refers to memory abilities that are retrieved without conscious or explicit access (Fox, 1999: 199 & Lupien *et al.,* 1997: 2070).

Cortisol has been found to affect memory function in individuals undergoing psychological stress, such as an exam and in the elderly and affects changes in memory and learning functioning (Heffelfinger and Newcomer, 2001: 491-513 and Newcomer *et al.,* 1994: 2047-2053).

In a double blind, placebo-controlled study, young and elderly men were given a word list to learn. After this, delayed recall was tested. A second word list was learnt and recalled after drug (cortisol) administration. To make the testing more broad-based and accurate, the Paragraph Recall Test and tests measuring working memory (Digit Span), attention (Timed Cancellation) and response inhibition (Stroop Colour and Word Test) were administered. Cortisol was found to reduce recall of the word list before treatment in both groups of men. However, recall of the list was

not influenced after treatment. Cortisol reduced Digit Span in the young but not in the elderly men (Wolf *et al.,* 2001: 1002-1011).

Two different studies to investigate the association between cortisol levels and memory performance in healthy adults showed that high levels of cortisol impaired memory. The first study exposed 13 subjects to a brief psychological laboratory test with a subsequent test of declarative memory performance (Kirschbaum *et al.,* 1996: 1475-1483). It was found that subjects with high cortisol response to a stressor showed poorer memory performance. The second study set out to determine whether cortisol alone, in the absence of a stressor, would impair memory function. Forty healthy subjects received either 10 mg of cortisol or a placebo orally. An hour later, these subjects were tested for procedural and declarative memory and spatial thinking. Those subjects who received cortisol showed impaired performance in declarative memory and spatial thinking tasks but not in the procedural memory task. Thus, free cortisol is responsible for declarative memory impairment (Kirschbaum, 1996: 1475-1483 & Lupien *et al.,* 1997: 2070). Cortisol not only decreases memory, it can also significantly alter attentional processes. When healthy subjects were engaged in an attention task, which was then followed by 15 minutes of a stressful video game and then a return to the attentional task, it was found that their reaction times were decreased after playing the video game. Cortisol levels were found to be responsible for the delayed reaction time (Skosnik *et al.,* 2000: 59-68). Anxiety also affects comprehension but highly anxious individuals produce overt articulation of words in an attempt to compensate for strategies such as the control of reading speed, regressive fixations and poor memory, which appear to be problematic in such individuals (Calvo & Eysenck, 1996: 289-305).

It has also been observed that the higher an individual's perceived levels of stress are, the higher their cortisol levels tend to be (Lupien *et al.,*

1997: 2070 & Pruessner *et al.,* 1997: 622). Perceived levels of stress are naturally higher during an exam period and so the higher the cortisol levels. Thus the poorer short-term memory performance is and the worse an individual's ability to be attentive (Vedhara *et al.,* 2000: 535-549).

2.2.4 Cortisol, Anxiety and Immunity

Stress and thus its symptoms as discussed previously, significantly alter endocrine and immune function. Cortisol down regulates the immune system in several different parts by inhibiting interleukin-1 and interleukin-2 production as well as inhibition of the monocytes to present antigen (Malarkey *et al.,* 1995: 499 – 500).

Cortisol reduces the number of eosinophils and lymphocytes in the blood and this is one of the most important clues diagnostically for the overproduction of cortisol by the adrenal gland. Also, large amounts of cortisol administered to individuals, results in atrophy of lymphoid tissue and this in turn results in a decrease of both T-cells and antibodies from the lymphoid tissue throughout the body. This means that the body's immunity to most foreign organisms is decreased. This, in turn, predisposes an individual to develop diseases he would otherwise not have acquired and may result in death from fulminating diseases like tuberculosis. High cortisol levels can be beneficial, however, in transplant patients where the risk of immunological rejection is high (Guyton & Hall, 1996: 965). This immunological deficit is also found to be the case in athletes as physiological and immune consequences of acute bursts of physical exercise parallel an acute psychological stressor. Over-training my result in melancholic depression and anxiety appears to make the athlete more susceptible to injury and ill health (Clow & Hucklebridge, 2001: 5-17).

Stressful experiences not only influence immune function but also influence neuroendocrine, immune and cytokine functioning as well as physiological and psychological well being. Post-graduate students, who were undergoing lengthy anticipatory periods preceding a scheduled stressor, were found to report feelings of malaise, headaches, sore throats and fatigue more often than the well-matched control group. In the students, cortisol levels were elevated one hour prior to the exam (most noticeably in female students) and in contrast, mitogen-stimulated lymphocyte proliferation was only reduced 6-8 weeks before the exam. This suggests that cortisol is associated with immediate threats while immune alterations are sensitive to more distant threats or events or are subject to adaptation in response to a protracted stressor (Lacey *et al.*, 2000: 339-356).

In a study to test emotional stability, anxiety and natural killer cell (NKC) activity under examination stress, it was found that examination stress induced significant decreases in NKC activity in low emotional stability and high anxiety individuals. In individuals with high emotional stability and low anxiety, there was increased NKC activity and in individuals with medium emotional stability and medium anxiety, there was no decrease in NKC activity. This demonstrates the link between poor immunity and anxiety, and emotional stability and immunoenhancement (Borella *et al.*, 1999, 613-627).

Academic stress was also found to have an effect on serum concentrations of interleukin (IL)-receptor (R) antagonist (A), soluble (s) IL-2R, sIL-6R, soluble glycoprotein (sgp) 130, Clara cell protein (CC) 16, sCD8 and sCD14. In this study, relationships between changes in the above anti-inflammatory variables, levels of serum cortisol and scores on the perceived stress scale (PSS) or the State-Trait Anxiety Inventory (STAI) were also examined. It was found that examination stress causes significant increases in PSS and STAI scores and in serum spg 130,

sCD8, IL-1RA, sIL-6R and CC16 values. These values were higher in women who took oral contraceptives and generally higher in men than in women. This study thus shows that psychological stress induces immune-inflammatory changes, a decreased anti-inflammatory capacity of serum and interactions with T cell and monocyte activation. It also indicates that sex hormones may modify stress-induced immune-inflammatory responses (Song *et al.,* 1999: 293-303).

In a parallel study to determine the effect of psychological stress on the production of pro-inflammatory and immunoregulatory cytokines, it was concluded that psychological stress greatly increases the stimulated production of tumour necrosis factor alpha (TNF- alpha), IL-6, IL-1RA, interferon gamma (INF-gamma) and IL-10 (Maes *et al.,* 1998: 313-318). Another study found that psychological stress induces changes in PSS and results in higher concentrations of serum IgA, IgG, IgM and alpha 2-macroglobin and a more marked increase in students with higher stress perception (Lowe *et al.,* 2000: 721-722; Maes *et al.,* 1997: 397-409 & Maes *et al.,* 1998: 313-318).

2.2.5 Cortisol and Systemic Disease

High levels of cortisol that are present in the blood for long periods of time may result in systemic diseases such as Cushing's syndrome.

Cushing's syndrome is usually iatrogenic and usually due to prolonged immunosuppression with synthetic glucocorticoids. Cushing's syndrome is divided into three types:

- ACTH dependent: This includes pituitary-dependent bilateral adrenal hyperplasia, ectopic ACTH syndrome and iatrogenic.
- Non-ACTH dependent: adrenal adenoma and carcinoma cause this.

- Pseudo-Cushing's syndrome: This is usually as a result of alcohol abuse, major depressive illnesses and/or primary obesity (Edwards *et al.,* 1999: 580-581). A recent study showed that fat distribution plays a large role in the subtle alterations in the hypothalamic-pituitary-adrenal axis and sensitivity to glucocorticoids. It was concluded that abdominal body fat distribution women had comparatively increased nocturnal cortisol excretion, increased salivary cortisol response to ACTH stimulation and increased primary sensitivity to dexamethasone testing as opposed to women with subcutaneous body fat distribution (Duclos *et al.,* 2001: 447-454).

A similar study found that central body fat distribution is related to a greater psychological vulnerability to stress and cortisol reactivity. This study also shows that stress-induced cortisol secretion may contribute to central fat, and demonstrates a link between psychological stress, high cortisol levels and the risk for disease (Epel *et al.,* 2000: 623-632).

2.2.6 Cortisol Measurement Tests

Adrenocorticotropin (ACTH) controls cortisol secretion. ACTH has a diurnal secretion pattern and therefore cortisol levels are highest in the morning on waking and lowest in the middle of the night (Edwards *et al.,* 1999: 580). A recent study found that cortisol levels 20 and 40 minutes after waking were significantly higher during 800-lux exposure than during darkness. The experiment was repeated at night but the light had no effect on the cortisol levels. This study demonstrated that light conditions early in the morning have a strong impact on morning-cortisol levels but that evening cortisol levels are unaffected by light (Lupien *et al.,* 1997: 2070-2075; Nomura *et al.,* 1997: 85-90; Scheer & Buijs, 1999: 3395-3398 & Schmidt-Reinwaldt *et al.,* 1999, 1654-1660). This shows that serum cortisol and salivary tests are not as accurate as a mean 24-hour test, such as the Beckman Access Test ® used in this study, as

this test takes these peaks and troughs at 8am and 9pm, respectively into account (Brook & Marshall, 1998: 70). Thus, the 24-hour urine free cortisol test is capable of measuring an overall increase or decrease in cortisol levels (Chernecky & Berger, 1997: 406).

The serum cortisol tests are also problematic as inserting a needle into vein results in an elevation in cortisol levels and thus the readings are less accurate (Brook & Marshall, 1998: 70 & Chernecky & Berger, 1997: 406).

2.2.6.1 The Beckman Access Test®

The Access Cortisol Assay is a paramagnetic particle, chemiluminescent immunoassay for the quantitative determination of cortisol levels in human serum, plasma (heparin, EDTA) or urine using the Access Immunoassay System (Beckman Instruments, 1997: 1).

2.3 Treatment of Anxiety

2.3.1 Allopathic Treatment

Many different drugs have been used over the last 50 years that help to control feelings of anxiety. However, most of these allopathic drugs, called anxiolytics (Beers, 1999: 1631), tend to result in negative side effects (the most common being drug dependence) and are only effective to a limited degree (Casacalenda & Boulenger, 1998: 722-730; Lloyd, 1999: 1088; Moller, 1999: 2S-11S & Schlebusch, 1990: 40 and 331).

Benzodiazapines and especially Diazepam are the most frequently prescribed anxiolytics and also have a sedative function as well as being hypnotics, muscle relaxants and anticonvulsants (Beers, 1992: 1631;

Lloyd, 1999: 1088; Moller, 1999: 2S-11S & Schlebusch, 1990: 49 and 331). Individuals treated with benzodiazapines frequently complain of difficulty thinking, slowness of speech and comprehension, poor memory, faulty judgment, narrowed attention span and emotional lability. Dependence on these drugs causes depression of superficial skin reflexes, fine-lateral gaze nystagmus, ataxia, slurred speech and at a later stage nystagmus on forward vision, confusion, deep sleep, small pupils, respiratory depression and finally death (Beers, 1999: 1560). Relapse after Diazepam use is also very probable (Moller, 1999: 2S-11S & Schweitzer & Rickels, 1996: 9-12).

Other drugs used to treat anxiety disorders include tricyclic antidepressants and MAOI (monamine oxidase inhibitors) anti-depressants and Beta-blockers (Lloyd, 1999: 1088).

Beta-blockers treat peripheral, autonomic manifestations of somatic anxiety. Thus, symptoms such as heart palpitations and shortness of breath improve. Beta-blockers are often very effective in treating performance anxiety and a single dose of a beta-blocker is enough to calm an individual before stressful events (Beers, 1999: 1634). Beta-blockers, however, have many Central Nervous System (CNS) effects resulting in sleeping disorders, fatigue and lethargy. They may also cause impotence in men, impaired glucose tolerance, depressed high-density lipoprotein (HDL) cholesterol and an overall increase in total cholesterol and triglycerides. Beta-blockers are contra-indicated in individuals with a history of asthma, heart failure, sick sinus syndrome and first-degree heart block (Beers *et al.,* 1999: 423). Tricyclic antidepressants tend to be addictive and may cause postural hypotension, tacchycardia, blurred vision, xerostomia, constipation and sedation (Beers *et al.,* 1999: 1605).

MAOIs are effective in treating anxiety with associated panic disorder but may cause paradoxical hypertension and several dietary and drug interactions. Individuals may also suffer from erectile dysfunction, anxiety, insomnia, oedema and weight gain (Beers *et al.,* 1999: 1606).

2.3.2 Psychological Treatment

Explanation and reassurance are important in the control and management of all forms of anxiety. It is vital that the patient understands the nature of the symptoms and that they are part of the anxiety, which is a recognized illness. Individuals who do not respond to reassurance use relaxation techniques, which are also vital in the treatment of panic attacks (Lloyd, 1999: 1088).

Desensitization therapy makes use of the relaxation response as a counter response to stimuli that previously elicited feelings of anxiety in the individual (Lloyd, 1999: 1088 & Rawlins, Williams & Beck, 1993: 200). This is achieved through relaxation training and techniques and these include:

- hypnosis and self-hypnosis
- meditation
- regular exercise
- proper breathing
- calming thoughts and positive statements
- expression of feelings
- construction of a hierarchy of situations that elicit anxiety, and
- working through each situation in the hierarchy until the situation that causes the greatest anxiety in the individual can be approached and relaxation maintained. This hierarchy of anxiety must be approached through real-life situations or imagery (Rawlins *et al.,* 1993: 200).

- muscle relaxation and visualization (Kaplan & Sadock, 1985, 320; Rawlins *et al.,* 1993: 201; www.anxiety.ontario.com, 2002; www.depression.about.com,2002;www.owl.english.purdue.edu,2000).

Implosive therapy is when the individual is exposed to an anxiety stimulus at the top of the hierarchy but does not involve relaxation techniques. The individual is shown that the resulting anxiety is not unbearable by repeated exposure to the anxiety-inducing stimulus (Rawlins *et al.,* 1993: 200).

It has also been found that students who were hopeful of doing well during an examination displayed poor coping strategies for anxiety and thus performed less well than those students who felt more anxious but had better anxiety coping strategies (Onwuegbuzie & Snyder, 2000: 803-806).

In a study conducted by Raffety *et al.,* (1997) to differentiate between facilitating and debilitating trait anxiety, that is situational anxiety and coping with an anticipated stressor, respectively, it was found that anxiety and coping changed over time. It was also found that high and low levels of debilitating trait anxiety and facilitating trait anxiety were associated with different daily patterns of anxiety and coping. Individuals with debilitating trait anxiety as opposed to facilitating trait anxiety had lower test scores, higher anxiety and fewer problem-solving coping strategies. Co-varying debilitating trait anxiety and high facilitating trait anxiety was associated with higher levels of tension, support-seeking behaviour, proactive and problem-solving coping strategies.

Students who carry out relaxation techniques before exams have significantly higher test scores than those students who do not. However, it was found that there was no significant mean difference between the two groups of students on the Cattell and Scheier Anxiety

Scale and two-item measure of self-esteem (Schreiber & Schreiber, 1995: 929-930).

2.3.3 Homoeopathic Treatment

2.3.3.1 History of Homoeopathy

Homoeopathy was founded by Dr Christiaan Frederick Samuel Hahnemann in Germany in 1796. Dr Hahnemann was an allopathic medical doctor who had become disillusioned by the standard method of treatment at the time. These practices included purging, bloodletting and toxic doses of substances such as mercury (Eizayaga, 1991: 30 & Hahnemann, 1997: 30).

Dr Hahnemann was also the first physician to connect biology and psychology with physics in a practical system of therapy (Close, 1997: 273) by using infinitesimal doses of substances to treat certain pathologies on a mental, emotional and physical level.

2.3.3.2 General Principles of Homoeopathy

Homoeopathy involves the science and art of healing and preventing disease in individuals. Homoeopathy is a side-effect free, therapeutic approach and involves several general principles according to Eizayaga (1991: 35), which include:

- Law of Similars: This law states that a remedy will cure an illness if the symptoms of that remedy approximate the symptoms of the disease most closely (Eizayaga, 1991: 35).
- Provings on Healthy Persons: Experiments conducted using small doses of drugs that are administered to healthy individuals until symptoms appear. These symptoms are then recorded in a Materia Medica (Eizayaga, 1991: 35 & Ullman, 1991: 11).

- Diluted, Attenuated and Dynamized Medicine: The more diluted (by means of the process of succussion) a medicine is, the more effective and penetrating its action will be on the body. The quantity of drug required is inversely proportional to its similarity to the disease condition and the symptoms of the patient (Eizayaga, 1991: 37).

2.3.3.3 Combination Remedies

Using a combination of more than one medication or remedy at the same time to treat a patient is known as polypharmacy. Polypharmacy may be individualized or non-individualized. Individualized polypharmacy makes use of remedies, which are tailored to suit the individual patient. Non-individualized polypharmacy uses several of the most commonly used remedies to treat a specific condition so that the practitioner can bypass the necessity to individualize each case and in so doing prescribe the same remedy to different individuals suffering from the same condition. The assumption of non-individualized polypharmacy is that whichever remedy in the complex is best suited to an individual will bring about cure in that individual and the other non-indicated remedies will have no effect on the individual (Cook, 1989: 73 & Watson, 1991: 71-72).

The particular homoeopathic complex that was used in this study was the same complex as used by Traub (2000) at the Technikon Witwatersrand. The complex consisted of *Argentum nitricum* 200CH, *Kalium phosphoricum* 200CH and *Gelsemium sempervirens* 200CH.

2.3.3.4 Potency Selection

The following rules generally apply to potency selection:

- Low potencies (3X-30X) are used in acute conditions and administered over a short period of time, that is low doses frequently
- High potencies (200CH-CM) are prescribed in chronic illnesses and in cases where cure is aimed at the mental-emotional level. These potencies are usually taken three times a day, once a day or even on a weekly basis (Cook, 1989: 86-88).

2.4 The Complex Remedy: *Argentum nitricum* 200CH, *Kalium phosphoricum* 200CH and *Gelsemium sempervirens* 200CH

2.4.1 *Argentum nitricum*

This is silver nitrate. In allopathic treatment silver nitrate is used in a 1% solution to treat neonatal gonococcal conjunctivitis. It is also used to treat catarrh of the eye, ulcers and opacities of the cornea homoeopathically. However, homoeopaths more frequently prescribe *Argentum nitricum* for nervousness and anxiety (Tyler, 1995: 78).

According to the *Materia Medica, Argentum nitricum* is used to treat anxiety with symptoms that include:

- Inco-ordination, lack of balance both mentally and physically
- trembling of parts, errors in perception, paraplegia, disseminated sclerosis of brain and spinal cord
- fear and nervousness, weak memory, melancholy
- fear of death and anxiety about impending doom and things pending may be accompanied by diarrhoea with the appearance of spinach flakes
- great mental exhaustion, headaches and nervous excitement

- violent heart palpitations and irregular heart beat
- hysteria and impulsivity
- fear of losing self-control
- incoherent speech and depression
- frequent desire to urinate
- often suffer from shortness of breath of a nervous origin (Boericke, 1998: 72-75; Kent, 1994: 136-142;Tyler, 1995: 80 & Vermeulen, 1997: 162-170).

2.4.2 *Kalium phosphoricum*

This is potassium phosphate. Potassium is an intracellular cation and is found within muscle tissue and is thus roughly proportional to an individual's lean muscle mass. A deficiency in potassium, or hypokalaemia, may produce muscle weakness and may result in paralysis and respiratory failure. There may also be muscle twitches and polyuria. An excess of potassium, or hyperkalaemia, may result in flaccid paralysis, nodal and ventricular heart arrhythmia (Beers *et al.,* 1999: 1000-1002). Phosphate deficiency results in confusion, dysarthria, parasthaesia, peripheral neuropathy, muscle weakness, myopathy, haemolytic anaemia, anorexia, nausea and vomiting and renal tubule dysfunction (Beers *et al.,* 1999: 976).

According to the *Materia Medica* anxiety, which is treated with *Kalium phosphoricum*, has symptoms, which include:

- prostration, weakness and fatigue
- neurasthaenia, mental and physical depression, which are usually caused by overwork and worry
- hysteria, irritability and nightmares also predominate
- weepiness, suffer from hypochondria, paranoia, fear of death and excruciating headaches accompanied by sensitivity to noise

- indigestion with nervousness, diarrhoea, nocturnal enuresis and excessive perspiration tend to occur, along with shortness of breath
- weak memories and suffer from forgetfulness and are easily startled
- impatience, impetuousness and difficulty articulating words
- neuralgias, headaches and cold hands and feet lethargy, nervous dread, shortness of breath from slightest exertion and paralytic lameness in the back and limbs
- urinary incontinence accompany this individual's complaint of anxiety (Boericke, 1998: 376-378; Kent, 1994: 645-653 & Vermeulen, 1997: 961- 965).

Other symptoms these individuals may complain of are:

- a dry mouth
- empty sensation in the pit of the stomach
- loss of sexual power
- sleeplessness from worry (Boericke, 1998: 376-378; Kent, 1994: 645-653 & Vermeulen, 1997: 961-965).

2.4.3 *Gelsemium sempervirens*

This plant is commonly known as yellow jasmine (Boericke, 1998: 299) and belongs to the family *Loganaceae*, which is indigenous to the Southern States of North America and is noted for its poisonous properties (www.ibiblio.org, 2000).

It contains two pregnane derivatives, 12-beta-hydroxy-5 alpha-preg-16-ene-3, 20-dione and 12-beta-hydroxy-pregna-4, 16-diene-3, 20-dione. Both these chemicals have cytotoxic effects (Shun & Cordell, 1985: 790) and *Gelsemium sempervirens* is specifically active upon the cerebro-spinal system (Jouanny, 1984: 156). In moderate doses *Gelsemium sempervirens* slows down the heart rate, causes feebleness of muscular

action and impairs the senses and results in cranial nerve 3 paralysis causing dilated pupils (www.ibiblio.org,2000).

Gelsemium sempervirens is used to treat anxiety with the following symptoms according to the *Materia Medica:*

- convulsions in the extremities, cramping of the fingers and toes, and in the back muscles
- confusion, forgetfulness and incoherent speech
- congestive headaches with violent pain in the occiput
- nervousness, excitement and fear, especially of sudden surprises
- heart palpitations and sudden attacks of diarrhoea brought on by anticipatory anxiety varying degrees of motor paralysis, dizziness, drowsiness and trembling and feelings of apathy
- emotional excitement results in spasms in the glottis and diarrhoea
- slowness of breathing, insomnia and nervous chills
- a great desire to be silent
- frequent urging to urinate
- loss voice from fright
- trembling, difficulty concentrating and incapacity to think are other prevalent symptoms (Boericke, 1998: 299-302; Kent, 1994: 543-548; Tyler 1995: 382-386 & Vermeulen, 1997: 770-779).

Thus, it can be seen that all three of these remedies are well suited to treating anxiety.

CHAPTER THREE

MATERIALS AND METHODS

3.1 Study Design

This study was randomized, double blinded and placebo-controlled. It involved twenty volunteers at the Technikon Witwatersrand. The study was conducted to determine the effectiveness of the homoeopathic complex remedy: *Argentum nitricum* 200CH, *Kalium phosphoricum* 200CH and *Gelsemium sempervirens* 200CH on cortisol levels and on perceived levels of anxiety in students.

3.2 Method

Ten volunteers formed part of the experimental group and the other ten volunteers formed part of the control group. These subjects were chosen and recruited by means of flyers (Appendix A). The volunteers had to comply with certain requirements and conditions as stipulated in the patient consent form and information sheet (Appendix B).

On the 13 February 2002, the volunteers performed a 24-hour urine cortisol collection (Appendix D). Each volunteer had his/her own numbered 3-litre urine collection bottle. Strict measures were taken to ensure that the volunteers collected the full amount of urine and that the volunteers' dignity and privacy were respected during the urine collection. This was done by keeping the urine collection bottles in the Technikon Health Clinic for the patients to use at their discretion. The cortisol baselines were measured at an independent pathology laboratory using the Beckman Access Test ®. This was to establish a baseline level for cortisol during a non-anxiety-inducing period. At the

same time, the volunteers were given the State-Trait Anxiety Inventory (STAI) to complete. This is a short ten-minute questionnaire, which helps to differentiate between a person who is anxious by nature and/or a person who suffers from situational anxiety. A registered psychologist conducted the questionnaire, as only a psychologist may conduct and interpret the results.

On the 7 May 2002, the day before the test, the volunteers were given their remedies to take. The remedy was dispensed in metered doses of three powders for each volunteer. The remedy or placebo was prepared in accordance with homoeopathic pharmacopoeias and in a homoeopathic laboratory to ensure that the remedy or placebo was of the highest standard. The powders were randomized and numbered by the homoeopathic laboratory that manufactured them. Volunteers were randomly assigned numbers, which were not known to the researcher in order to ensure that the study was double blind.

The three powders that the volunteers were given were taken at twelve pm and eight pm the day before the test and at eight am on the day of the test. The volunteers were thoroughly briefed as to how to take their medication correctly and were given a detailed pamphlet in this regard (Appendix C). This was to ensure that the volunteers knew exactly what was expected of them.

On 8 May 2002, the day of the exam, the volunteers once again had to perform a 24-hour urine collection to establish their cortisol levels under an anxiety-inducing situation. They also had to complete the STAI a second time-half an hour before their test commenced. Once again, a registered psychologist conducted and interpreted the results and the same independent laboratory measured the cortisol levels.

3.3 Subjects

This study involved twenty students from the Technikon Witwatersrand.

In order to be considered eligible for the study, the subjects had to meet the following criteria:

- All subjects had to be studying at a tertiary level and needed to be older than 18 years of age.
- Subjects would have to be individuals who suffered from feelings of anxiety before writing tests or examinations.
- Subjects could not be taking any medication used to treat anxiety or any medications known to raise cortisol levels.

The volunteers were divided into two separate groups, a control group and experimental group. Each group consisted of ten volunteers.

3.4 Homoeopathic Remedies

Each subject was given three powders, each powder was labeled with the volunteer's number and each powder was labeled either A, B or C. Volunteers were instructed to take each powder in alphabetical order at the instructed time. The powders allowed for accurate measured doses of the remedy.

The volunteers in the experimental group were given powders containing equal amounts of:

- *Argentum nitricum* 200CH
- *Kalium phoshoricum* 200CH
- *Gelsemium sempervirens* 200CH

The control group received the same instructions as the volunteer group and the powders were marked in the same way. The placebos had the same colour, texture and taste as the remedy powders.

Neither the researcher nor the volunteers knew who was part of the experimental or control group.

3.5 Measurement Techniques

3.5.1 The Beckman Access® Test

The Access Cortisol Assay is a paramagnetic particle, chemiluminescent immunoassay for the quantitative determination of cortisol levels in human serum, plasma (heparin, edetate calcium disodium) or urine using the Access Immunoassay System (Beckman Instruments, 1997: 1).

The following are the basic premises of the Beckman Access Test ®:

- Principles: This is a competitive binding immunoenzymatic assay. A sample is added to the reaction vessel, which contains rabbit antibody to cortisol, cortisol -alkaline phosphatase conjugate and paramagnetic particles coated with goat anti-rabbit capture antibody. Cortisol competes with the cortisol-alkaline phosphatase conjugate for binding sites on the specific anti-cortisol antibody. The resulting antigen-antibody complexes bind to the capture antibody on the solid-phase. Separation in a magnetic field and washing removes all unbound materials not bound to the solid-phase. A chemiluminescent substrate (Lumi-Phos 530) is added to the reaction vessel and light generated by the reaction is measured with a luminometre. The photon production is inversely proportional to the concentration of cortisol in the sample. The amount of anylate in the sample is determined by

means of a stored, multi-point calibration curve (Beckman Instruments, 1997: 1).

- Measurements: 24-hour urine cortisol is measured as follows:

  $$\text{Urine Cortisol (ug/24 hours)} = \frac{\text{Urine Cortisol (ug/dl)}}{100} \times \text{24-hour volume}$$

  The result is then expressed in ug/ml

  A normal result is between 39-348 ug/24-hours

- Limitations: The levels of cortisol detection by means of the Beckman Access test are between 0.4-60.0 nmol/l and elevated cortisol levels may occur in individuals receiving prednisolone Beckman Instruments, 1997: 3).

3.5.2 The State-Trait Anxiety Inventory

The State-Trait Anxiety Inventory (STAI) consists of separate self-report scales for measuring state and trait anxiety. The State (S)-Anxiety scale consists of twenty statements that evaluate how the individual being tested is feeling at the particular moment of filling in the scale. The Trait (T)-Anxiety scale also consists of twenty statements to test how the individual being tested feels generally (Spielberger, 1983: 6).

The STAI T-Anxiety scale is used to assess clinical anxiety in medical, surgical, psychosomatic and psychiatric patients. It is used to screen high school and university students and military recruits for anxiety problems and for evaluating the immediate and long-term outcome of psychotherapy, counseling, behaviour modification and drug-treatment programmes. The STAI has proved to be useful in identifying individuals with high levels of neurotic anxiety and for selecting individuals for psychological experiments who differ in motivation or drive level.

Psychoneurotic and depressed patients also tend to score high on this scale (Spielberger, 1983: 7).

In general, the S-Anxiety scores are higher when the scale is given under stressful conditions and lower when given under relaxed circumstances, whereas T-Anxiety scores are not generally influenced by stress.

Stability measured using test-retest coefficients is relatively high for the STAI T-Anxiety scale and low for the STAI S-Anxiety as is expected for a test measuring anxiety resulting from situational stress (Spielberger, 1983: 30-32).

The median correlation for seven sample groups was .65. Individuals high in T-Anxiety tend to be higher in S-Anxiety, even in neutral situations. In general, State-Trait Anxiety Theory predicts higher correlations between S-Anxiety and T-Anxiety in social evaluation situations and lower correlations in physical-danger situations. State-Trait anxiety correlations tend to be slightly higher when the STAI scales are given in the same testing session, one immediately following the other, but such correlations are markedly lower if the subjects are exposed to or threatened with some form of physical danger (Spielberger, 1983: 32-33).

3.6 Statistics

The numerical data for the State-Trait Anxiety Inventory and the 24-hour cortisol levels were statistically analyzed using Wilcoxon's matched pair's test. This is the non-parametric alternative to the t-test for dependent groups. A non-parametric method was decided upon due to the small size of the sample group (10 volunteers in the control group and 10 volunteers in the experimental group).

The STAI anxiety-free and anxiety-induced results and the 24-hour cortisol pre-and post results were analyzed independently of one another and inferences were made as to their statistical significance. The control and experimental group were then compared to one another to determine the significant differences between them.

CHAPTER FOUR

RESULTS

4.1 Introduction

This study involved 30 students from the Technikon Witwatersrand. Of these 30 volunteers, only 20 successfully completed the study due to poor volunteer compliance and volunteers who had aborted their studies. The 20 who completed the study were compliant with every aspect of the study.

4.2 Raw Data

The raw data is included in Appendix E. The lower the Trait anxiety scores the lower the individual's feelings of anxiety. The lower the State anxiety scores the lower the individual's feelings of anxiety. The higher the 24-hour cortisol scores the higher the individual's stress levels. The results are expressed as actual numbers and in percentages.

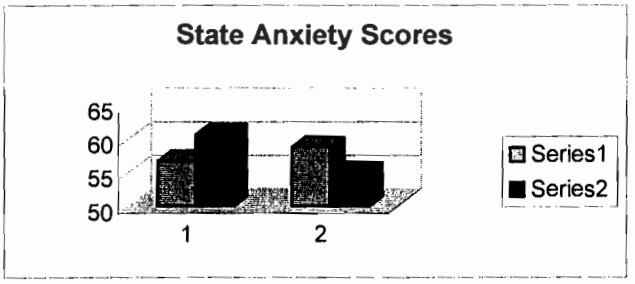
4.3 State –Trait Anxiety Inventory (STAI) Scores

4.3.1 State Anxiety Scores

Table 1 State Anxiety-Free and Anxiety-Induced Scores

	Experimental Group (Series 1)	Control Group (Series 2)
Anxiety-Free	56.73	58.80
Anxiety-Induced	60,67	55.09
p-value	0,236	0,085

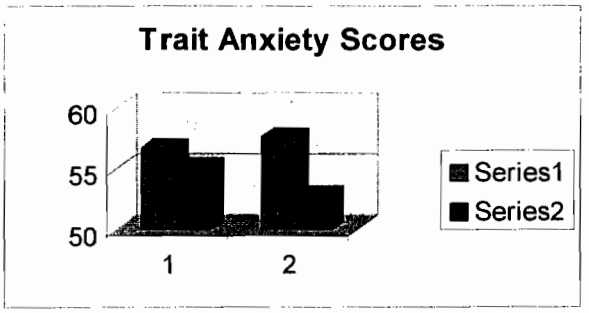
Figure 1 State Anxiety Scores



The experimental group had an overall 5,76% increase in State anxiety scores. The control group had an overall decrease in State anxiety scores of 6,31%. On analysis it was found that there was no statistical significance between the anxiety-free and anxiety-induced scores for both the experimental (p=0,236) and control (p=0,085) group, although the control group appeared to have a lower anxiety level than the experimental group.

The standard deviation for anxiety-free State anxiety scores was 8.071 for the experimental group and 6,241 for the control group. The anxiety-

Figure 2 Trait Anxiety Scores



The experimental group had an overall 2,75% decrease in Trait anxiety scores. The control group had an overall 8,41% decrease in Trait anxiety scores. On analysis of these scores it was found that there was no statistical significance between the anxiety-free and anxiety-induced scores for both the experimental (p=0,345) and control (p=0,678) groups.

The standard deviation for the anxiety-free Trait anxiety scores was 3,388 for the experimental group and 10,853 for the control group. The anxiety-induced Trait anxiety scores were 3,958 and 10,382 for the experimental and control group, respectively.

induced standard deviations were 8,726 for the experimental group and 10.717 for the control group.

4.3.2 Trait Anxiety Scores

Table 2 Trait Anxiety- Free and Anxiety-Induced Scores

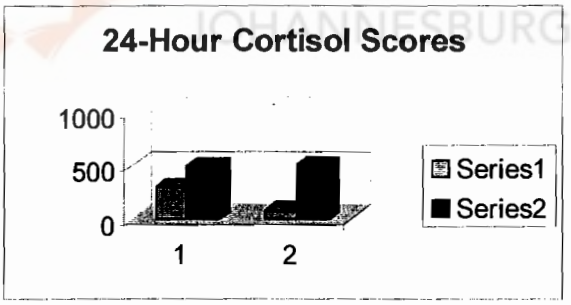
	Experimental Group (Series 1)	Control Group (Series 2)
Anxiety-Free	56.67	57,67
Anxiety-Induced	55,11	52,82
p-value	0,345	0,678

4.3.3 24-Hour Cortisol Scores

Table 3 Anxiety-Free and Anxiety-Induced 24-Hour Cortisol Scores

	Experimental Group (Series 1)	Control Group (Series 2)
Anxiety-Free	305,30	84,391
Anxiety-Induced	485,94	501,44
p-value	0,314	0,063

Figure 3 24-Hour Cortisol Scores



The experimental group had an overall increase of 59,17% in 24-hour cortisol results and the control group had an overall increase of 494,18% in 24-hour cortisol results. However, the anxiety-induced cortisol scores between the experimental and control group do not differ radically. On analysis of the scores it was found that there was no statistical significance between the anxiety-free and anxiety-induced scores for both the experimental (p=0,314) and the control group (p=0,063).

The standard deviations for the anxiety-free cortisol scores were 65,4011 for the experimental group and 61,4309 for the control group.

The standard deviation for the anxiety-induced 24-hour cortisol scores was 269,409 and 385,940 for the experimental and control groups, respectively.

CHAPTER FIVE

DISCUSSION

5.1 Discussion

This study was designed to establish whether a homoeopathic complex would reduce perceived levels of anxiety and subsequently reduce 24-hour cortisol levels.

The experimental group showed a slight increase in State anxiety and the control group showed a slight decrease in State anxiety. Although there was no statistically significant increase or decrease in State anxiety for both groups, the increase in State anxiety may have been much higher if no homoeopathic complex was given to the experimental group. The control groups decrease in State anxiety may have been due to the fact that they had previously completed the STAI and knew what to anticipate and thus were less anxious. In the anxiety-induced situation, the volunteers were also familiar with the procedure and with the researcher, which may have accounted for less anxiety as well.

Both the experimental group and the control group had Trait anxiety scores which remained almost static, this was to be expected as Trait anxiety is a person's natural predisposition to anxiety and is generally not influenced by an anxiety-inducing situation.

The 24-hour cortisol scores for both the experimental and control groups increased from the anxiety-free to anxiety-induced situation. However, the control group had a greater increase in cortisol levels as opposed to the experimental group. However, the anxiety-induced 24-hour cortisol scores for both the experimental and control groups were almost the

same. The lower cortisol levels for the control group in the anxiety-free situation may have been due to several factors and these include:

- lower feelings of anxiety in the control as opposed to the experimental group despite recruiting students who claimed to be anxious
- better self-esteem, higher ego-resiliency and gender as all these factors influence anxiety levels but were not taken into account in this study

The relatively equal anxiety-induced 24-hour cortisol scores could be due to the fact that in an anxiety-inducing situation all the above factors may be negligible due to the wide variability of individual responses to anxiety.

In a similar related study to research the influence of academic stress and season on 24-hour mean concentrations of ACTH, cortisol and B-endorphins found that:

- examinations caused a significant increase in perceived stress scores($p < .001$)
- and in students who perceived the most stress, cortisol levels significantly increased from baseline to examination ($p < .001$)

This study showed that the nature of the stressor and the state of the volunteer were equally important in the observed cortisol response. Season of year did not influence cortisol response (Malarkey *et al.*, 1995: 499).

Another study also found that individuals who perceived themselves to be anxious had a much higher increase in cortisol response than those individuals who felt less anxious. The study also showed that those individuals with a better ability to cope with a stressful situation had less of a cortisol increase than those with poorer coping ability (Pruessner *et al.*, 1997: 615-625).

Thus, although the results of this study to determine the effect of a homoeopathic complex on perceived levels of anxiety and subsequently cortisol levels were inconclusive, other studies have shown that perceived levels of anxiety do influence cortisol levels. Also, the homoeopathic complex may have lessened the degree to which the volunteer's cortisol levels may have increased had they not received the homoeopathic remedy.

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The results of the study showed that although the study did not produce statistically significant results, there was:

- an increase in experimental group and a slight decrease in the control group for the State anxiety scores
- for both the experimental and control groups Trait anxiety was unchanged.
- an increase in 24-hour cortisol results for both the control and experimental group. However, the control group had a much more significant increase than the experimental group.

As mentioned earlier, several factors may have had a negative effect on the study. This study did not take any volunteer's home or work situation into account and merely focused on their academic environment. The volunteers' individual personalities were not taken into account, nor their previous academic record, coping strategies or self-esteem and all of these factors may have made a difference to the amount of anxiety experienced by the volunteers and ultimately the final results of the study.

Although the results of the study showed that the homoeopathic complex had no significant effect on perceived levels of anxiety, several of the volunteers reported feeling much less anxious about the outcome of the test.

The homoeopathic complex did, however, have an effect on cortisol levels. Although, the results were not statistically significant, the lowering of the cortisol levels may have resulted in the volunteers reporting that they found that they were more able to focus during the test and were able to comprehend the questions more easily.

With more demands made on people everyday to be more intelligent, quicker and better than the next person, stress becomes more and more of a problem. This has far reaching implications such as recurrent infections due to a weakened immune system and thus poor work performance. Thus, a safe, side effect free homoeopathic remedy is needed to help alleviate the symptoms of stress. Thus, further study into homoeopathic remedies, which can reduce perceived levels of anxiety and cortisol levels, is required.

6.2 Recommendations

Although the study was a tremendous learning experience for the researcher, there were problems with the study.

The researcher recruited first year students, which was problematic as many first year students drop out of their course of study. This also meant that many of the volunteers were not as dedicated to the study as they may have been if they had been older. It proved difficult to arrange meeting times for performing the psychological tests and many of the volunteers came and went of their own accord which resulted in them disrupting their fellow volunteers, the researcher and the psychologist. Thus, the researcher recommends recruiting students from second or third year to avoid this. The researcher also recommends recruiting more than thirty volunteers.

The STAI is an American psychological test and thus has been standardized for use by American individuals. The researcher found that many of the students had difficulty understanding some of the words and questions in the questionnaire. An anxiety questionnaire aimed at the South African population may have yielded better results. Also the STAI was completed twice and so students had seen the questions before, which may have made testing less accurate. These two aspects were unavoidable, however.

Cortisol testing was problematic, as it required volunteers to urinate into collecting bottles over a period of 24 hours. This was uncomfortable for the volunteers and was a primary reason for poor volunteer compliance. Unfortunately, due to cortisol's diurnal fluctuations, it was necessary to obtain samples over 24 hours. Other studies have used saliva and blood samples. Saliva has found to give less accurate readings and drawing blood from an individual elicits more stress and results in inaccurate cortisol readings. The most effective way to obtain accurate 24-hour urine volumes would have been to have the volunteers catheterized. However, this is expensive and may result in urinary tract infections (Chernecky & Berger, 1997: 406; Edwards *et al.,* 1999: 580; Lupien *et al.,* 1997: 2070-2075; Nomura *et al.,* 1997: 85-90; Pruessner *et al.,* 1997: 615-623; Scheer & Buijs, 1999: 3395-3398 & Schmidt-Reinwaldt *et al.,* 1654-1660).

The study also only used three homoeopathic remedies in the complex. Different combinations of remedies may have yielded different/better results. Homoeopathy is a method of treatment, which involves personalizing symptoms thus, just because two people suffer from anxiety, does not mean they will receive the same homoeopathic remedy or remedies (Eizayaga, 1991: 61-71). The researcher recommends using individual prescriptions based on the volunteer's specific symptoms.

The researcher also recommends that if any follow up studies are done, that actual academic test results are also used to see whether or not the complex had an effect on academic results and not just on cortisol and STAI scores.

Despite the results of the study not showing statistical significance, many of the volunteers reported to the researcher that they had felt a marked improvement after taking the remedy/placebo. Thus, this complex may be useful in treating anxiety in some individuals if the remedies fit the symptoms of the individual. More research into homoeopathic remedies, which could significantly decrease cortisol hormone levels, would be beneficial to Homoeopaths and individuals suffering from feelings of anxiety, alike.

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Appendix A Flyer

STRESSED OUT?

Before tests and exams do you suffer from?

- anxiety and worry
- sleeplessness
- shortness of breath
- heart palpitations
- poor memory
- difficulty concentrating
- nausea and diarrhoea

Do you feel that your nerves affect your academic performance?

If yes, help is at hand!

Volunteer for a Masters Research Study aimed at reducing

USING

SAFE, EFFECTIVE AND SIDE – EFFECT FREE Homoeopathic medication

Contact Rowena for more information on 082 338 0653

Appendix B Subject Information and Consent Form

As a student you are aware of anxiety, be it from first hand experience or from listening to fellow students talking about their feelings of anxiety. A little anxiety is a good thing, but as you may well know, too much can be detrimental to your mental and physical health. I would like you to participate in a study aimed at helping to control and reduce the amount of the stress hormone cortisol. This stress hormone is responsible for your feelings of nervousness and anxiety as well as contributing to depleting your immunity to infection-which explains why one usually gets ill when your exams and tests are over!

If you participate in this study, you need to be older than 18 years of age. You will be required to give us two 24-hour urine samples for cortisol testing. The urine will be collected 15 days before a test and then on the day of the test. Each volunteer will be issued with a numbered, empty, three-litre sample bottle just before the collection begins. The sample bottles will be stored in the TWR Health Clinic for you to use at your discretion. The sample bottles will be taken home with you and returned to the TWR Health Clinic the next morning. On the days that your cortisol levels are tested you will be required to complete a 10-minute psychological test to measure your perceived levels of nervousness and anxiety.

As this is a double blind, placebo-controlled, fully randomized study, no names will be involved and the results of the study will be issued to the volunteers based on their volunteer number used during the research. Half of the volunteer group will receive a placebo and the other half the homoeopathic complex. Neither the researcher nor the volunteers will know who is receiving the placebo and who is receiving the homoeopathic complex.

Participation in this study is voluntary and you are free to refuse to participate in this study at any time throughout this study. A signed copy of this consent form will be made available to you. I have fully explained what is expected of you and answered all your questions.

Date: Researcher:

I have been fully informed as to my rights and as to the procedure to be followed in this study. I understand that I am free to withdraw my consent at any time. I know that any questions I have will be answered fully by the researcher.

Date: Volunteer:

Appendix C Taking and storing your homoeopathic remedy correctly

- Always ensure that your remedy is kept in a cool, dry place and away from direct sunlight
- The remedy powders should not come into contact with any strong smelling substances such as aromatherapy oils, mint toothpaste or coffee
- Always take your remedy half an hour before or after eating a meal, a snack or a cup of tea, coffee or cool drink or brushing your teeth
- Place the entire contents of the powder sachet under your tongue and allow the remedy to dissolve. Do not swallow your remedy!

Appendix D The 24-Hour Urine Collection Procedure:

1. Each volunteer will be provided with a three-litre urine collection bottle. This will be issued the day before the collection. Volunteers will be assigned a number and this number will be displayed on their collection bottle.

2. The first urine of the day once collection has begun is discarded. Thereafter all the urine up to and including the urine produced just after the 24 hours are up is collected in the sample bottles.

3. For the volunteers' convenience, the collection bottles will be housed in the TWR Health Clinic whilst volunteers attend lectures, to be used at the volunteers discretion. Sample bottles will be taken home for the overnight part of the collecting procedure.

4. For the second urine collection on the day of the test, the same collection procedure will be followed as in points 1 – 3. However, if one of the volunteers needs to urinate during the test, the researcher will be at the test venue with smaller collection bottles which will be used and later decanted into that particular volunteer's larger three – litre collection bottle.

Appendix E Raw Data

Experimental Group State-and Trait-Anxiety Scores

Volunteer Number	First Round (Anxiety-Free)				Second Round (Anxiety-Induced)			
	State		Trait		State		Trait	
	Raw Score	Standard Score	Raw Score	Standard Score	Raw Score	Standard Score	Raw Score	Standard Score
2	38	52	45	57	39	53	37	49
3	44	54	40	50	67	74	48	57
4	42	56	46	58	39	53	45	57
11	41	55	42	54	54	67	41	53
12	51	65	45	57	53	66	51	64
14	32	44	42	52	55	64	48	57
16	29	43	43	55	41	55	41	53
18	39	53	42	54	59	72	49	62
19	42	53	38	48	50	59	51	60
20	59	67	45	55	37	49	38	48
Average	41,7	54,2	42,8	54	49,4	61,2	44,9	56

Control Group State-and Trait-Anxiety Scores

Number	First Round (Anxiety-Free)				Second Round (Anxiety-Induced)			
	State		Trait		State		Trait	
	Raw Score	Standard Score	Raw Score	Standard Score	Raw Score	Standard Score	Raw Score	Standard Score
1	40	51	43	53	57	65	42	52
5	40	51	51	60	31	44	41	51
6	42	56	48	61	32	46	30	41
7	52	65	56	69	54	67	33	44
8	68	74	69	78	66	74	71	78
9	54	63	62	71	39	50	59	68
10	35	47	32	42	42	53	37	47
13	37	51	29	40	27	41	27	38
15	47	57	48	57	30	43	37	47
17	47	61	51	64	54	67	53	66
Average	46,2	57,6	48,9	59,5	43,2	55	43	53,2

Table 6 Experimental Group Cortisol Results

	Sample Volume		Urine Cortisol		Urine Cortisol/ 24 hours	
Volunteer Number	Anxiety Free	Anxiety Induced	Anxiety Free	Anxiety Induced	Anxiety Free	Anxiety Induced
2	900	1300	270	218	243	283.4
3	900	620	209	1149	188.1	712.38
4	1720	1250	104	422	178.88	527.5
11	520	950	507	349	263.64	331.55
12	1800	1500	244	129	439.2	193.5
14	1400	950	241	258	337.4	245.1
16	520	400	283	780	147.16	312
18	480	600	521	422	250.08	253.2
19	1610	800	111	1195	178.71	956
20	420	850	563	373	236.46	317.05
Average	1027	922	305,3	529,5	246,26	413,17

Table 7 Control Group Cortisol Results

	Sample Volume		Urine Cortisol		Urine Cortisol/ 24 hours	
Volunteer Number	Anxiety Free	Anxiety Induced	Anxiety Free	Anxiety Induced	Anxiety Free	Anxiety Induced
1	500	1400	225	440	112.5	616
5	600	1050	116	465	69.6	488.25
6	2000	1100	91	423	182	465.3
7	500	1420	216	767	108	1089.14
8	250	700	120	539	30	377.3
9	600	1900	140	136	84	258.4
10	130	980	57	87	7.41	85.26
13	1400	980	124	395	173.6	387.1
15	1600	800	42	1030	67.2	824
17	350	600	316	293	110.6	175.8
Average	793	1093	144,7	457,5	94,49	476,66