Effects of Ylang ylang essential oil on physiological and socio-psychological variables in females

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DECLARATION OF OWN WORK

I, Guida Maria van der Westhuizen, hereby declare that this research project submitted for the **Magister Technologiae: Somatology** degree in the **Faculty of Health and Environmental Sciences** at the **Central University of Technology, Free State**, is my own independent work and has not previously been submitted to any institution by myself or any other person in the fulfilment of the requirements for the attainment of any qualification.

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SIGNATURE OF STUDENT **DATE**

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SUMMARY

Effects of Ylang ylang essential oil on physiological and socio-psychological variables in females

The role of the modern woman has drastically altered within the last 20 years. Aiming to find a balance and adequate time to address both family and work demands requires fine planning and compromise, most likely leading to a woman who is overstressed, fatigued, impatient and anxious. A fatigued body, induced by stress overload, may result in an elevation in blood pressure, pulse rate and breathing rate. These physiological alterations may predispose individuals to cardiovascular disease and a compromised immune system. Currently, the dynamics between physiological changes within the body and the influence of aromatherapy essential oils are not well defined or researched. Limited information is available to explain the influence of aromatherapy essential oils as a complementary and alternative medicine (CAM) on female physiological parameters, specifically blood pressure, pulse rate and breathing rate. The aim of the research study firstly was to evaluate the physiological alterations in the female human body in response to aromatherapy Ylang ylang essential oil, and secondly, to determine the perceptions regarding the physiological and psychological abilities of the participants upon completion of the treatment course. The outcome of this study will contribute to the scientific knowledge of aromatherapy essential oils as a CAM therapy.

A single blind, experimental case-control study design was followed. This research study recruited 36 voluntary female participants from the Bloemfontein area between the ages of 20 and 45 years. The 36 participants were divided equally into group A and B. Group A commenced with the face control (carrier oil only), followed by three face experimental treatments (Ylang ylang essential oil blend). Thereafter, the back control was conducted, followed by three back experimental treatments. Similarly,

group B commenced with three back experimental treatments, followed by the back control. The three face experimental treatments followed and concluded with the face control. Demographic and post-treatment questionnaires were utilised to ascertain demographic data and any perceptive physiological and psychological changes. The blood pressure, pulse rate and breathing rate physiological parameters were measured by utilizing the Nihon Kodhen apparatus.

Physical stress indicators such as elevated pulse rate, systolic blood pressure, diastolic blood pressure and breathing rate increased during stress were reduced at a quicker rate in aromatherapy treatments where Ylang ylang essential oil was present. Dermal application of Ylang ylang essential oil produced more prominent improvements when applied to the back area, indicating that a larger absorption surface provides superior improvements in the physical parameters. Most participants perceived an improvement in stress levels, concentration levels, energy levels and self esteem levels. In general, it seems probable that Ylang ylang essential oil had a positive effect on stress and had a reductive effect on some of the physiological parameters.

The topic of complementary and alternative therapies is a diverse one. Various opinions, whether justifiable or not, are possibly influencing the public domain which has become directed at CAM therapies as alternatives to conventional medicine. The most evident and probable shortcoming in CAM therapy research lies in the lack of scientific research and evidence. Thus, more research is required in order to contribute to this field of study by adding knowledge and provide a better understanding of the topic. This study has contributed to the knowledge of CAM therapies.

KEY WORDS: Aromatherapy, Ylang ylang essential oil, CAM therapy, stress, blood pressure, pulse rate, breathing rate, women’s health.

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LIST OF ABBREVIATIONS AND SYMBOLS

%	Percent
vs.	Versus
CAM	Complementary and alternative medicine
CNS	Central nervous system
DIA	Diastolic blood pressure
ECG	Electrocardiogram
HASA	National Association for Holistic Aromatherapy
Kg	Kilogram
Min	Minute
ml	Milliliters
mmHg	Millimeters of mercury
PMS	Premenstrual syndrome
PMS	Pre-menstrual syndrome
PNS	Parasympathetic nervous system
SNS	Sympathetic nervous system
SYS	Systolic blood pressure
WHO	World Health Organisation

Chapter 1
Introduction

1.1 Background

The role of the modern woman has changed drastically over the last 20 years. Modern women are potentially no longer solely focused on providing a conducive home environment, but could be multi-focused on professional careers, child rearing, as well as providing an optimal home environment. This variety of roles could result in the expansion of a woman's day-to-day responsibilities. Aiming to find a balance and adequate time to address both family and work demands requires fine planning and compromise, most likely leading to a woman who is overstressed, fatigued, impatient and anxious.

The human body is not equipped to handle long periods of physiological and psychological distress and after a period of continuous exertion, the body will plunge into a fatigued state (Konduru, 2011). A fatigued body, induced by stress overload, may result in an elevation in blood pressure, pulse rate and breathing rate (Dusek and Benson, 2009; Hull, 2011). These physiological alterations may predispose individuals to cardiovascular disease and a compromised immune system. Kelly, Tyrka, Anderson, Price and Carpenter (2008) conducted research into the gender differences in the physiological and emotional responses of 32 women and 30 men in response to the Trier Social Stress Test. The results of the study showed that women are more susceptible to stress than their male counterparts (Kelly *et al*., 2008).

Currently, the dynamics between physiological changes within the body and the influence of aromatherapy essential oils are not well defined or researched. A review conducted by Butje, Repede and Shatell (2008) in the nursing field in the United States concluded that aromatherapy shows potential as a safe complement or alternative to traditional Western medicine. Limited information is available to explain

the influence of aromatherapy essential oils as a complementary and alternative medicine (CAM) on female physiological parameters, specifically blood pressure, pulse rate and breathing rate. A blend of lavender, roman chamomile and neroli essential oils were utilised in a research study at Eulji University Hospital in Korea to assess the effects of aromatherapy on sleep, anxiety and the vital signs of 60 intensive care unit patients (Cho, Min, Hur and Lee, 2012). The results of the study indicated that stabilization of blood pressure, reduction in anxiety and improved sleep occurred. Thus, Cho *et al*. (2012) identified aromatherapy as an alternative therapy that would be beneficial for nursing intervention provided that more research be conducted into essential oils and aromatherapy.

Aromatherapy is classified as a holistic CAM therapy (Zhang, Wu, Chen, Yao, Liu, Pan, Hu, Zhao, Xie and Jia, 2013). CAM encompasses holistic therapies which focus on the prevention of disease through the enhancement of relaxation in order to facilitate optimal physiological and psychological functioning within the body (Barret, 2004).

1.2 Aims and objectives

1.2.1 Aims

The aim of this research study was firstly to evaluate the physiological alterations in the female human body in response to aromatherapy Ylang ylang essential oil, and secondly, to determine the perceptions regarding the physiological and psychological abilities of the participants upon completion of the treatment course. The outcome of this study will contribute to the scientific knowledge of aromatherapy essential oils as a CAM therapy.

1.2.2 Objectives

The objectives of this research study were threefold:

To collect demographic data regarding age, marital status, offspring, employment and stress status from the participant by means of the completion of the demographic questionnaire (Appendix A);

To record the physiological changes in blood pressure, heart rate and breathing rate during the practical research sessions, whereby essential oil treatments were compared to non-essential oil treatments. Standard operating methods were utilised to determine the blood pressure, heart rate and the breathing rate; and

To assess socio-psychological changes by means of a post-treatment questionnaire (Appendix B) that resulted as a by-product of the initial study. The aspects included the following: energy, stress, concentration, sexual drive, patience levels and self-esteem perceptions.

Chapter 2
Literature Review

2.1 Introduction

Aromatherapy has developed into a popular branch of complementary or alternative therapy in the modern world, designed for holistic health maintenance (Lis-Balchin, 1997; Gould, 2003; McGuinness, 2003; Jenkins, 2006). Cooke and Ernst (2000) and Wilkinson, Aldridge, Salmon, Cain and Wilson (1999) agree with this statement, adding that on the opposite side of the spectrum there are hardly any lucid indications for application of aromatherapy and minimal evidence exists of the value derived thereof. Aromatherapy was plainly defined by Price and Price (1999) and McGuinness (2003) as the art of using essential oil matter derived from aromatic plant materials. Collectively, Beckmann and Le Quesne (2005) termed aromatherapy as utilising the smell mechanism to induce a therapeutic effect. The optimal description of the practice of aromatherapy would be to merge both interpretations as the therapeutic effect in the body is a direct result of the exposure of the body to the essential oil molecules.

The origin of aromatherapy can be traced back and identified in texts/recordings from civilisations dating back as far as 2000 BC (McGuinness, 2003; Nordmann, 2007). The pioneers of aromatherapy were the ancient Egyptians, who extracted aromatics by infusion and used the essential oils for religious and medicinal purposes, for cosmetics, and to embalm the dead. One of the major contributions made by the Egyptians is called “kyphi”, a mixture of 16 aromatic materials which was later adopted for perfume and internal medicine by the Greek and Roman empires (Lawless, 2002; McGuinness, 2003). “Kyphi” was said to have antiseptic, relaxing, sedative and anxiety reducing properties (Lawless, 2002). Egyptians boasted a vast knowledge of aromatic plants, which was later shared with the Greeks. According to Gould (2003), the greatest Greek contribution came from the Greek physician,

Hippocrates. Hippocrates is known to human kind as the “father of medicine”. His work highlighted and recorded the use of plants for medicinal purposes (Battaglia, 2003; Edris, 2007). Gould (2003) writes that Hippocrates stated: “The way to health is to have an aromatic bath and a scented massage everyday”.

The interest in aromatherapy in modern times was awakened in July 1910 by Réné Maurice Gattefossé, a French chemist, when he accidentally burnt his hand in a laboratory accident at his family’s perfumery business (Battaglia, 2003). According to Battaglia (2003) and Beckmann and Le Quesne (2005), Gattefossé deliberately treated his burns by applying lavender oil to his hand. The result was that the hand healed free from blistering or scarring, as would have been the result from a severe burn. Gattefossé was the founder of the French term “aromatherapie” and he wrote the first book on aromatherapy in 1937. In the 1960s, Dr Jean Valnet, a surgeon in the French army, continued the work in aromatherapy by publishing the outcomes obtained from the application of essential oils to wound conditions during World Wars I and II (Crebbin-Bailey, Harcup and Harrington, 2005). Valnet later introduced aromatherapy in the treatment of mentally disturbed patients in psychiatric hospitals.

Based on Valnet’s work, the concept of aromatherapy was introduced to Britain in the 1950s by Madame Marguerite Maury, an Austrian biochemist, beauty therapist and aromatherapy enthusiast. Maury’s emphasis in the study of aromatherapy and essential oils was on health and the aesthetics of individuals (Hudson, 1994; Gould, 2003; Beckmann and Le Quesne, 2005). Extensive research was conducted by Maury on the possible effects of aromatherapy on the physical and mental state of the body. Her research findings were documented in the book, *The Secrets of Life and Youth,* written by Maury herself (Jenkins, 2006). The concept of dilution of essential oils and the application thereof by means of massage were developed by Maury. She recommended that essential oils not be ingested orally, as ingestion could potentially lead to heart, liver and kidney necrosis or death. Therefore, Maury’s recommendation provided a direct contradiction to medical aromatherapy, which was promoted by French doctors at the time (Battaglia, 2003). She initiated and erected a clinic in London during the 1950s, aimed at educating the beauty therapist on the use of aromatherapy essential oils in combination with massage techniques (Gould,

2003). The current aromatherapist still practices and utilises the principles developed by Maury and these principles are widely used in hospital facilities, hospices and clinics (Jones, 2009). Nye (2012) indicated that when dealing with an essential oil and its aroma; one is dealing directly with a fundamental force and entering the very core of the alchemy of creation. Maury's rooted expertise gave rise to a curiosity about the properties that these aromatic plant-derived essential oils contain (Nye, 2012). In order to understand the impact of essential oils on holism, optimum understanding needs to be obtained on aromatherapy and essential oils as a holistic complementary treatment.

2.2 Aromatherapy

The term aromatherapy can be split into two distinct parts. The word "aroma" is from Greek derivation and is a term used for spice, although in modern times it is a term generally allocated to fragrance. "Therapy" is an alternative term used for treatment, also derived from Greek origin. Aromatherapy can be classified into two basic strands, namely medical and holistic aromatherapy.

Medical aromatherapy reigns as a branch of aromatherapy that is still practiced by medical doctors in France and most of Western Europe. Essential oils incorporated into the mainstream medical field are antifungal, antiviral and antibacterial. Historically, French doctors broke new ground when treating contagious diseases by utilising undiluted essential oils internally. Battaglia (2003) quoted Drs Christian Duraffourd and Jean-Claude Lapraz, who are French doctors and are currently the President and General Secretary of the International Federation of Association of Defense in Phytotherapy Research and Teaching, on their views on using essential oils in cancer treatment by saying: "Our position with regards to the internal use of aromatherapy is very clear. As pure essential oils are extremely active agents having some demonstrable effects on the different organs of the body, pure undiluted essential oils need to be administered under medical supervision". This quotation emphasizes the danger of ingesting pure undiluted essential oils orally. Pure essential oils can slow down or accelerate the enzyme production of the liver. Therefore, if the window of action of pharmaceutical medication is narrowed, it is

dangerous to incorporate essential oils which may speed up or slow down the processing of the medication within the body which would limit the effectiveness of the pharmaceutical medication. For individuals who have compromised liver functioning, the pure essential oils would not be effectively excreted and would result in a toxic build up of the pure essential oils within the body.

In a similar manner, toxicity due to excessive accumulation can occur in healthy individuals because the liver will process less complex substances first. The oral consumption of pure undiluted essential oils in medical aromatherapy in the form of capsules or suppositories to address infections is the factor that distinguishes it from holistic aromatherapy which is based on skin absorption and inhalation of diluted essential oils. For the purpose of holistic aromatherapy, essential oils are combined/diluted with a carrier oil of vegetable origin, thus the essential oils are not applied directly to the skin in pure undiluted form (Gould, 2003). The combining of essential oils and carrier oils is applied in the same manner for the process of inhalation. The motivation behind the combination of essential oils and carrier oils is that the combination reduces the chance of allergic skin or inhalation reactions due to the dilution. Furthermore, once the combined mixture is taken up into the body, any excessive amounts of essential oils combined with the carrier oil will easily be removed from the body via eliminatory processes such as exhalation, faeces, urine and sweat (Battaglia, 2003).

Aromatherapy is termed a holistic complementary therapy approach, which thus implies that the focus of assisting a person lies in the treatment of the entire person, body, mind and spirit (Kumar, 2002; Nordmann, 2007 and 2011). The word “holistic” is derived from “holos”, a Greek word signifying being whole. Kumar (2002) emphasizes that individuals expect holistic care from the medical vocation/field. Figure 1.1 illustrates the six dimensions of health, namely, physical, mental, emotional, spiritual, social and environmental. Therefore, holistic aromatherapy can be described as treating the person as a whole, instead of selectively treating only the symptoms of a disease condition (Battaglia, 2003). Thus, holistic aromatherapy directly translates into the use of scent or fragrance for preventative or curative

treatments (Hudson, 1994) by the application of aromatic compounds called essential oils.

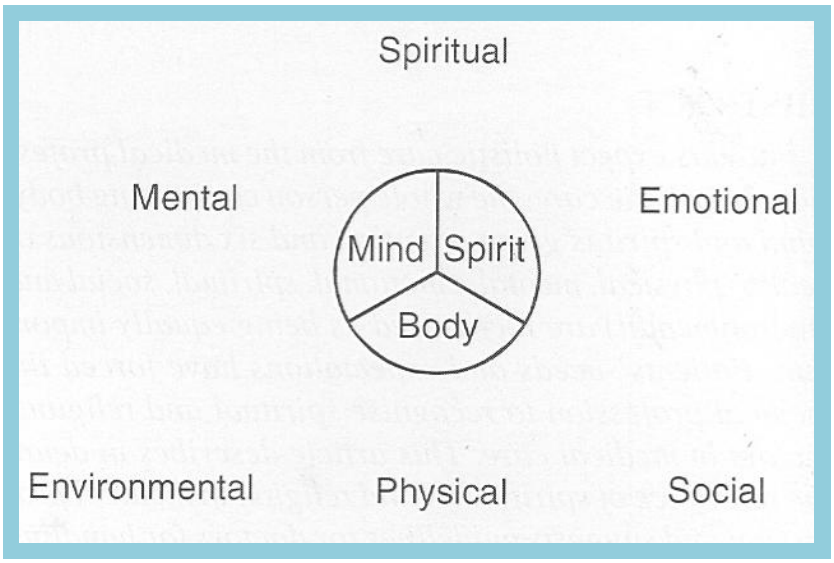

Fig 1.1: Whole person comprising body, mind and spirit and the dimensions of health. (Adapted from Kumar, 2002)

The contrast between the approach of conventional Western medical practitioners and holistic or CAM therapists is rooted in the inclusion or exclusion of psychological and spiritual factors (Figure 1.1). However, the lack of scientific research in CAM therapies gives rise to many discrepancies and disputes on whether the inclusion of the psychological and spiritual factors can benefit health and wellbeing (Kumar 2002).

Essential oils are capable of influencing physiological and psychological wellbeing (Battaglia, 2009). CAM therapists focus on holistic approaches to assist an individual; however, scientific research is lacking to support the importance of approaching health care in this manner. Thus, the lack of scientific research gives rise to resistance from conventional Western medical health care. Howdyshell (1998) substantiates that the medical profession addresses pathophysiological ailments, but fails to take care of patients' emotional needs. Aromatherapy is recognised as a therapy that can be used to fill the gap and thereby the patient's response to conventional treatment is enhanced (Howdyshell, 1998).

2.2.1 Essential oils

Essential oils are volatile materials and odorous compound extractions from aromatic plant materials (Jones, 2009). Research conducted by Steflitsch and Steflitsch (2008) indicated that essential oils have countless physical and pharmacological actions that are pertinent in almost every section of medicine, rather as a preventative than an alternative curative option. Essential oils have a variety of beneficial properties and effects (Table 1.1).

Table 1.1: Main therapeutic properties of essential oils

Properties of essential oils
• Antiseptic, antibacterial, antiviral, antifungal
• Wound-healing, granulation-promoting
• Analgesic, anti-inflammatory, antitoxic, hyperaemic
• Relaxing, sedative, antidepressive
• Spasmolytic, digestive, diuretic
• Immunostimulant, hormonal
• Insecticidal, repellent
• Mucolytic, expectorant
• Deodorant

(Adapted from Steflitsch and Steflitsch, 2008)

The three elements that essential oils are comprised of are carbon, hydrogen and oxygen. The stratum corneum (keratinized topmost layer) of the epidermis acts as a barrier for absorption as a protective function. The fat soluble nature of essential oils and the presence of the subcutaneous skin epidermal layer ascribes to the absorption and bioavailability of the essential oils. The bioavailability ultimately leads to the essential oils entering the bloodstream, resulting in the essential oils' distribution throughout the entire body to induce therapeutic effects (Nordmann 2007; 2011).

Biochemical experiments suggest that essential oils are synthesized in the areas of photosynthetic functioning which encircles the plants oil glands (Battaglia, 2003). These plant materials are used for the enhancement of an individual's mood, health and cognitive functionality. Essential oils are extracted from different regions of plants

and therefore not limited to flowers (Battaglia, 2003; Jones, 2009). Flower petals, leaves, stems, bark, wood, resins, roots, fruit peels or the entire plant can be used for essential oil extraction, depending on the plant family the essential oil is derived from (Battaglia, 2003; Jones, 2009). Furthermore, essential oils that differ in composition and odour can be derived from different parts of the same plant. A good example of different essential oils originating from the same plant occurs in the bitter orange tree which yields orange essential oil from the peel of the fruit, petitgrain essential oil from the leaves, and neroli essential oil from the flowers (Jones, 2009).

Essential oils can be introduced into the body in four ways: through the skin, inhalation, orally and rectally (Battaglia, 2003; Buckle, 2006; Gurib-Fakim, 2006). Essential oils are used for a variety of different applications and it is feasible to use these oils in diverse ways. The most frequently practiced methods of using essential oils include massage, vaporisers, diffusers, burners or baths (Battaglia, 2009). Oral and rectal administration is commonly carried out by medical practitioners however the incorrect dosage of essential oil introduction orally could potentially be fatal, if the dosage is high enough. If the dosage is non-lethal, the dosage can cause irreversible kidney and liver damage. Nearly all recorded cases of essential oil poisoning have occurred due to oral consumption (Battaglia, 2003; Nordmann, 2007).

2.2.2 Process of essential oil dermal absorption

The skin, which is made up of the epidermal and dermal layers, is semi-porous, thus allowing substances to enter the body via the skin route (Nordmann, 2007). Certain locations on the skin of the human body are more porous and permeable than other areas, thereby leading to increased absorption rate of essential oils in locations such as the thinner skin of the forearms, palms, forehead, soles and scalp by the process of diffusion (McGuiness, 2003). A decreased absorption rate occurs in areas where the skin is reasonably thicker, such as the upper body, abdominal area and the legs (Nordmann, 2007). The size of the essential and carrier oil molecules are minute, thereby allowing the molecules to easily filter through the skin.

Two routes for essential oil absorption on the skin exist, namely the follicles of the hair and the epidermal pore openings. The most important factor for dermal absorption lies in the coupling between the skin's sebum, produced by the sebaceous gland, and the size of the essential oil molecules. The coupling of the essential oil, together with the sebum, boosts dermal absorption. Once the essential oil has been absorbed, the epidermal blood and lymph capillaries deposit the essential oil molecules into the bloodstream (WHO, 2006). The bloodstream then distributes the essential oil molecules throughout the entire body in order for the essential oils to metabolise. Once metabolism is complete, the essential oils are excreted from the body through sweating, faeces, urination and breathing.

Essential oil molecules can stay within the body from a few minutes up to numerous hours before excretion. The amount of time spent in the body depends on the chemical composition, consistency and type of essential oil used. The skin does not allow absorption of animal or mineral fats. Therefore, any essential oils mixed into synthetic carrier oils will not be absorbed by the skin. It is highly relevant that carrier or base oils be of pure vegetable origin. Essential oil absorption is enhanced when exposed to heat treatments and friction. The heat and friction enhance blood flow to the skin's surface, thereby resulting in an excellent absorption rate through the skin (WHO, 2006).

2.2.3 Process of essential oil inhalation

A variety of administration modes for essential oils exist. Battaglia (2003) recorded that the best methods of Ylang ylang essential oil administration is by topical dermal application and via the inhalation process. Massage practices, compresses, bath soaks and skin products are the best practices for optimal Ylang ylang dermal absorption, whereas vaporisers, humidifiers and diffusers are best for inhalation of Ylang ylang essential oil (Battaglia, 2003).

Inhalation takes place when essential oil molecules enter both the mouth and nose. This absorption continues into the respiratory tract and lungs. The lung's mucous casing allows essential oil diffusion through the capillary walls to deposit the essential

oil molecules directly into the blood circulation, which is then spread to the whole body (Nordmann, 2007).

The second inhalation route of essential oils for entrance into the body is via olfaction. Essential oils absorbed by the nasal mucous membranes are picked up by cilia (Dohms, 2010). The cilia, which look like little hair projections, recognise the essential oil molecule and direct this information to the limbic system. The limbic system is the area of the brain that interprets smell and connects directly to the areas of the brain that regulate breathing rate, heart rate, levels of stress, blood pressure, endocrine balance and memories. Thus, the limbic system is responsible for the emotions or feelings that a certain smell or aroma can induce (Aromatherapy Science, 2006).

2.2.4 Background of Ylang ylang essential oil

The botanical name for the plant that produces Ylang ylang essential oil is *Cananga odorata* (Lam.) and the Ylang ylang essential oil originates from the custard-apple botanical family known as Annonaceae (Battaglia, 2003; Jenkins, 2006; Manner and Elevitch, 2006). Lawless (2002) and Gould (2003) identified an alternative name for Ylang ylang, *Unona odorantissimum,* which translates into flower of flowers. Ylang ylang is indigenous to South-East Asia; particularly Indonesia and the Philippines. The major primary producers of the *C. odorata* tree and distributors of Ylang ylang are found in Madagascar and the Comoros Islands (Lawless, 2002; Battaglia, 2003). C. odorata is a rapidly growing, tall, tropical evergreen tree, which flowers throughout the year and can grow to between 20 and 30 metres. However, even though the tree flowers throughout the year, the focal flower harvests occur early on in the arid season. The *C. odorata* tree produces flowers that are varied in colour (Lawless, 2002; Battaglia, 2003).

The most frequently seen colours of the flowers yielded by the *C. odorata* tree are yellow, green-yellow, pink or mauve in shade and possess a strong heady scent. The yellow flowers have been singled out as the finest for essential oil extraction (Beckmann and Le Quesne, 2005). Two variations of essential oils are produced by

the flowers of the *C. odorata* species in the Annonaceae family (Lawless, 2002; Battaglia, 2003). The two variations are *C. odorata* f. *Macrophylla* oil known as cananga oil and the popular *C. odorata* f. *Genuina* from which Ylang ylang essential oil is obtained (Lawless, 2002; Battaglia, 2003). Lawless (2002) states that Ylang ylang essential oil is best suited for aromatherapy purposes mainly because of its refined quality.

2.2.5 Characteristics of Ylang ylang essential oil

Essential oils are classified according to the sedative or stimulating properties that the essential oil possesses. Essential oils are further categorised according to the essential oil's volatility, and the volatility is classified as top, middle or base note. Ylang ylang essential oil is a sedative essential oil and has the volatility of a base note. A base note essential oil exhibits slow evaporation characteristics which ultimately implies that Ylang ylang essential oil will produce effects within the body for a longer period (up until 72 hours) than the middle and top note essential oils (Price and Price, 1999; Battaglia, 2003; Gould, 2003; McGuiness, 2003; Nordmann, 2011).

The odour of Ylang ylang essential oil is optimally characterised as striking, tremendously sweet and intense, with a spicy floral undertone (Battaglia, 2003; McGuinness, 2003; Beckmann and Le Quesne, 2005). Ylang ylang essential oil is described as a pale yellow oil (Battaglia, 2003; Beckmann and Le Quesne, 2005).

Base notes are characterised as having the slowest evaporation potential of all essential oils known. Collectively, base notes are also absorbed slowly into the skin. It is imperative that base note essential oils be on the skin for a minimum of 100 minutes in order to be fully absorbed. Whereas the slow absorption is a hindrance, once the base note essential oil has been absorbed, the essential oil is maintained and therapeutic effects are induced for an extended period of five to seven days. Base note essential oils are attributed with having a deep aroma for relaxation and sedative benefits (Nordmann, 2007; 2011). Based on the length of time that base note essential oils have a therapeutic effect within the body, Ylang ylang essential oil

should exhibit longer-lasting physiological and psychological benefits for an individual as opposed to a top note essential oil.

2.2.6 Extraction method for Ylang ylang essential oil

Ylang ylang essential oil is extracted from the freshly cut flowers of the *Cananga odorata* tree early in the morning of the summer months through the process of water or steam distillation (Battaglia, 2003; McGuinness, 2003; Beckmann and Le Quesne, 2005). Nordmann (2007; 2011) identifies the process of steam distillation as the most universal method of essential oil extraction from plant materials. This method entails exposing the flower plant material to very high temperatures through steam. The steam causes the essential oil molecules to evaporate out of the plant material. A condenser is utilised to compact the spray into a liquid form, consisting of essential oil and water. As oil molecules and water do not mix, an oily layer consisting of the essential oil is formed above the water. Draining of this fatty layer occurs and only the flower water remains (Battaglia, 2003; Nordmann, 2007; 2011). Water distillation is the alternative method for Ylang ylang essential oil extraction.

The process of water distillation does not differ greatly from steam distillation. The difference lies in the first step of the extraction process. In water distillation, the plant material needs to be chopped up into fine pieces. The thoroughly cut up flower plant material is placed in water, brought to boiling point and the steam is thereafter condensed in exactly the same manner as steam distillation (Battaglia, 2003; Nordmann, 2007; 2011). The initial distillate is named Ylang ylang extra; thereafter, consecutive distillates are named Ylang ylang first, second and third grade (Battaglia, 2003; McGuinness, 2003; Beckmann and Le Quesne, 2005).

Table 1.2: Typical chemical composition of the various grades of Ylang ylang

Constituent	Extra %	1st Grade %	2nd Grade %	3rd Grade %
Linalool	13.6	18.6	2.8	1.0
geranyl acetate	5.3	5.9	4.1	3.5
Caryophyllene	1.7	6.0	7.5	9.0
p-cresyl methyl ether	16.5	7.6	1.8	0.5
menthyl benzoate	8.7	6.4	2.3	1.0
benzyl acetate	25.1	17.4	7.0	3.7
benzyl benzoate	2.2	5.3	4.7	4.3
other sesquiterpenes	7.4	28.8	54.5	97.0

(Adapted from Lawrence, 1986 cited in Battaglia, 2003)

The managers of the companies producing Ylang ylang essential oil grade the different traits of the oils by the severity of the odour (Battaglia, 2003). As no established standards exist, the values of the differing grades differ from one producing company to another. This aspect of unregulated grading must be considered when purchasing Ylang ylang essential oil. Battaglia (2003) emphasises that for the purpose of traditional aromatherapy application, focusing on relaxation and antidepressant actions, the most suitable grades to use would be extra or first grade Ylang ylang essential oil as it is the purest form (Table 1.2) (Harding, 2002; Battaglia, 2003).

2.2.7 Indications, effects and actions of Ylang ylang essential oil

Exposure of humans to aromas results in physiological and psychological effects. A physiological effect has a direct result on the physical body, whereas the psychological effects occur because the olfactory system, which is responsible for smell, is stimulated and leads to a physiological reaction (Hongratanaworakit, 2004). The use of Ylang ylang essential oil has been recognised in many instances, namely, as a libido booster, a hypotensive and a sedative. According to Akutsu, Tanaka, Murakami, Nakajima and Nagashima (2006), the physiological changes that occurred upon exposure to Ylang ylang essential oil fragrance were significant blood pressure

and heart rate decreases in human beings. Battaglia (2003) states that the main therapeutic actions of Ylang ylang essential oil on physiological functioning are that the essential oil relieves depression, counteract septic conditions, decrease blood pressure and is a general relaxant. Ylang ylang essential oil also has an euphoric effect on the individual (Hudson, 1994) and Pitman (2004) adds that Ylang ylang essential oil is beneficial for tachycardia, heart palpitations, shock, anxiety, anger and frustrated anger.

Apart from relaxation, the indications for Ylang ylang essential oil usage in aromatherapy are diverse. Ylang ylang essential oil is indicated for normalising the functioning of the different body systems. In the case of the circulatory body system, Ylang ylang is recommended to address rapid or irregular heart beat and decrease hypertension (Battaglia 2003). Regarding the nervous system, Ylang ylang essential oil is indicated for reducing rapid breathing resulting from shock, depression, anger, fury and frustration (Gould, 2003). Ylang ylang essential oil is advantageous for addressing premenstrual syndrome (PMS) originating in the female reproductive body system and low libido. On the topic of skin care, Ylang ylang essential oil is recognised for softening and harmonising skin moisture. Ylang ylang essential oil boasts a balancing action on sebaceous gland production, which produces the skin's natural oil called sebum. This action is therefore beneficial for dry skin types by increasing sebaceous gland activity and decreasing sebaceous gland activity in oily skin types (Battaglia, 2003). McGuinness (2003), Jenkins (2006) and Beckmann, Le Quesne (2005) and Manner and Elevitch (2006) further highlight that Ylang ylang essential oil is useful for stress related tribulations, anxiety and dilated capillaries due to the relaxation effect the essential oil has on the sympathetic nervous system (SNS).

A study was conducted by Seo (2009) to determine the stress mechanism response in adolescents when exposed to aromatherapy. Seo concluded his study by confirming that inhalation of aromatherapy oils is a very effective method for stress management in secondary school students. While this confirmation affirms the impact of general aromatherapy oils, one must take into consideration any specific

contraindications and contra actions that could result from the application of Ylang ylang essential oil.

Although no definite contra indication for Ylang ylang essential oil exist, as a precaution, Jenkins (2006) advises, that Ylang ylang essential oil should not be used on a person struggling with low blood pressure as Ylang ylang essential oil will result in continued lowering of blood pressure. Based on the range of indications Ylang ylang essential oil is designated for, it is important to determine the physiological and psychological impact within the body.

2.2.8 Safety aspects

Toxicity manifests itself in one form in all individuals. Pure, undiluted essential oils should not be applied directly onto the skin, as the concentration of the oil might be too strong and could lead to toxicity and skin reactions such as sensitisation or an allergic reaction (Battaglia, 2003; Gould, 2003). Toxicity is more commonly known as poisoning. Poisoning can occur when the administration of essential oils are too aggressive. Overexposure can thus be fatal. In aromatherapy, the method in which the essential oils are applied, largely determines the level of poisoning that could occur. Dermal toxicity is the term used in the aromatherapy profession to indicate the type of poisoning that can result. Dermal toxicity refers to the amount of toxicity that is absorbed through the skin. As stated previously, the greatest danger lies in the swallowing of pure essential oils as is general practice in medical aromatherapy. Toxicity can have different effects, depending on the time frame of exposure. Acute cases of toxicity result from a single dose or exposure. When the essential oils administered are below a lethal dose, the liver and kidneys will receive most of the damage. On the opposite side of the spectrum, chronic toxicity results from exposure over prolonged periods of time and result in body tissue damage. Later, the chronic exposure could lead to degeneration of the normal functioning of the kidneys and liver (Aromatherapy Science, 2006).

Compared to toxicity, skin reactions can differ drastically from one individual to the next. As Battaglia (2003) and Pitman (2004) state, an irritated skin reaction develops

when the skin's protection mechanism is triggered by a primary irritating substance through contact. The irritation process is normally very fast, depending on the percentage of the substance causing the irritation, in other words, the stronger the irritating substance the quicker the irritation reaction will occur. Some essential oils are classified as potential irritating substances, particularly on individuals with sensitive skin types and possess the ability to cause allergic urticaria (Battaglia, 2003; Pitman, 2004).

Allergic urticaria is an alternative descriptive name for a sensitisation reaction to essential oils. A sensitisation reaction is very similar to irritation; however, slight differences are noted. The visual result of sensitisation could include erythema, blotchiness, a rash, and sometimes even the formation of blisters. Sensitisation evokes the body's immune system to deal with the substance causing the problem. The substance, which is the antigen, activates the body's immune system to fight the foreign irritant. The immune system's counteractive strategy is to produce antibodies to neutralise the effect of the antigens on the skin. In the case of an individual becoming sensitised to an essential oil, the essential oil needs to be removed immediately and any contact, whether internal or external, with that essential oil must be terminated. Once an individual has become sensitised, even slight contact with minute amounts of the essential oil could result in severe inflammation of the skin (Battaglia, 2003).

Safety in utilising essential oils for holistic aromatherapy is generally considered to be good as the eliminatory process in the body will eliminate any excess essential oils. However, the percentage of the pure essential oil used could trigger physical ailments if the percentage is above the body's capacity for dealing with the reactions. Precautions that need to be taken into consideration with regard to safety aspects when using Ylang ylang essential oil arise from an increased tendency of developing headaches and nausea due to the heavy scent Ylang ylang essential oil possesses (Harding, 2002; Battaglia, 2003; Gould, 2003; McGuinness, 2003; Beckmann and Le Quesne, 2005). Beckmann and Le Quesne (2005) recommend the usage of Ylang ylang essential oil in moderation to prevent the previously mentioned contra actions. Likewise, Ylang ylang essential oil is identified as a probable skin sensitiser

(McGuinness, 2003; Beckmann and Le Quesne, 2005). In direct contrast, Battaglia (2003) states that Ylang ylang essential oil is non-sensitising provided that the aromatherapist applies the correct aromatherapy principles and has adequate knowledge of aromatherapy. The success of an aromatherapy treatment could therefore be attributed to the extent of accurate aromatherapy knowledge the aromatherapist possesses, furthermore emphasizing the importance of in-depth research to ascertain physiological responses within the human body to Ylang ylang essential oil.

For the purpose of this research study, Ylang ylang essential oil was identified to be the essential oil of preference for the treatment procedures, as Ylang ylang essential oil has been identified by earlier research (Burdock and Carabin, 2007) to possess sedative and antiseptic properties. Knowledge gained from engaging with literature from Steflitsch and Steflitsch (2008) indicates that essential oil application, whether it is through skin absorption or inhalation, is safe unless it is used erroneously. In addition, a reduced probability exists for the occurrence of a negative skin reaction as the lowest percentage of the pure (extra grade) Ylang ylang essential oil is used in the blend. Therefore, the incidence of contra actions such as headaches, nausea and skin sensitisation is dramatically reduced.

2.2.9 Carrier oils

Essential oils need to be blended with a natural carrier or base oil to prevent any adverse reaction (Nordmann, 2007), and through combining essential oils and pure vegetable carrier oils, an increase in the absorption power via the skin is achieved. The skin structure absorbs fat soluble substances better than water soluble ones. The term, essential oils, is a direct contrast to the name, as essential oils are not actually oily in build up but rather the best way to ensure that essential oils are readily absorbed into the skin is by combining the essential oils with an all-natural vegetable carrier oil. A good carrier/base oil generally exhibits good qualities such as possessing a medium thickness, minimal or no smell, are water or alcohol insoluble, and have low instability (Nordmann, 2011)

The thickness of the carrier base oil plays an essential role in the absorption ability of the skin. The thicker the carrier oil, the more difficult skin absorption will be. Carrier oils that have been cold pressed are highly recommended as a base oil for essential oils, as the nutrient content is high, thus benefiting the skin and without decreasing or hindering the affectivity of the therapeutic properties the essential oils possess. Cold pressing maintains the additional benefits of the carrier oil because only extreme pressure is applied to the plant material, forcing the carrier oil out and excludes saturation by chemicals or solvents that reduce the effectiveness of the carrier oil. Untainted, natural carrier oil, resulting from cold pressing is considered the optimal carrier or base oil for aromatherapy. Grape seed is a great example of unadulterated cold pressed carrier oil (Nordmann, 2007; 2011).

Grape seed oil is one of the most popular carrier oils used by aromatherapists, the main reason being that grape seed oil is a versatile oil that can purposefully be applied in many ways and for many different conditions. Grape seed oil, also known as *Vitis vinefera,* is extracted from different varieties of grape seeds (Hudson, 1994). Unfortunately, according to Harrison (2008), the shelf life of this versatile carrier oil is quite short, ranging between 12 and 14 months. Grape seed oil is one of the most cost effective and safest carrier oils to use in aromatherapy, as it contains no nut trace material which could trigger nut allergies in some individuals (Nordmann, 2007; 2011). Thus, for this research study, grape seed carrier oil is best suited to use in conjunction with Ylang ylang essential oil as it is cost effective and has no probability of inducing allergic reactions, in order to establish the influence on an individual's blood pressure, heart rate and breathing rate.

2.3 Complementary and alternative therapy

In recent years, the interest and use of CAM therapies (Table 1.3) is continuously emerging globally and has progressively grown (Pham, Yoo, Tran and Ta, 2013). Therefore, it can be concluded that a considerable number of individuals are adopting health care treatments outside the borders of conservative Western medical practices (Cushman and Hoffman, 2004). An article discussing the integration of CAM therapies with conventional medicine highlighted that the growing interest in CAM

therapies has led to an emerging trend directed at the amalgamation of the varied CAM therapies with conventional health care structures (Barret, 2004). The above-mentioned article was disputed by Boozang (1998), who indicated that it is not morally acceptable that a medical practitioner offers or recommends alternative therapies when the usefulness of these therapies remain unverified. However Ernst (2003), in direct contrast to Boozang, states that after several years of dismissing CAM therapies as hype, the medical profession is currently clamouring to evaluate these claims.

In the face of the increased interest and usage of CAM therapies, the progress in research in CAM therapies is overdue and warranted. CAM therapies are beginning to infiltrate conventional medical institutions such as hospitals, hospices and senile care facilities. The correct use of these therapies will complement conventional medical practices, consequently enhancing the level of patient care (Howdyshell, 1998). A national study conducted by Astin (1998) indicated that 95% of the 1035 participants had a holistic orientation to health. Astin (1998) further concluded that the increase of individuals utilising CAM therapies did not result from discontentment with conventional medicine, but rather because these CAM health care options were similar to the individuals personal values and beliefs. Barret (2001) utilised the following table extracted from the research work of Astin (1998) to identify the examples of CAM therapies that are gaining popularity.

Massage and relaxation are two of the most popular alternative therapies, whereas aromatherapy is not highlighted as being popular (Table 1.3). However, aromatherapy mostly utilizes massage and essential oils in order to achieve relaxation. Aromatherapy can be applied in two ways, namely; the essential oils on their own or the essential oils in conjunction with a massage. Aromatherapy (essential oils) in itself has a relaxation effect and when essential oils are combined with massage therapy, relaxation is induced at a faster rate and have effects that last well beyond the cessation of the treatment. Thereby, the incorporation of aromatherapy essential oils on their own in daily life could boost the overall effect of relaxation as an alternative therapy for any individual.

Table 1.3: Examples of CAM therapies

CAM Therapies		
Acupuncture	Feldenkrais	Music therapy
Acupressure	**Folk remedies**	Naturopathy
Aromatherapy	**Herbal medicine**	Neuromuscular therapy
Art therapy	**Homeopathy**	Phytotherapy
Astrology	Hypnosis	**Prayer**
Ayurvedic	**Imagery**	Reflexology
Biofeedback	Iridology	**Relaxation**
Chinese medicine	**Lifestyle diet**	Reiki
Chiropractic	**Massage**	**Self-help group**
Craniosacral therapy	Meditation	Shiatsu
Dietary supplements	**Megavitamins**	**Spiritual healing**
Energy healing	Midwifery	Tai chi
Exercise	Mind-body therapy	Yoga
Therapies in bold are those identified as the most common by Astin (1998) and Eisenberg (1998)		

(Adapted from Astin and Eisenberg, 1998 cited in Barret, 2001)

Another argument regarding CAM therapies is brought to light by Ernst (2008) who pinpoints the ways in which the public are misled regarding complementary and alternative therapies. Ernst argues that CAM therapies have been deemed untrustworthy and precariously deceptive to the public by studies conducted by Schmidt and Ernst (2004) and Weeks, Verhoef and Scott (2007). Ernst (2008) further claims that complementary and alternative therapies defy scientific investigation as most CAM aficionados allege that the scientific method of research is not relevant in their respective fields. The reasons provided by CAM aficionados for these claims are that the effects of complementary and alternative therapies cannot be measured statistically and additionally as each treatment is custom-made for an individual and consequently is not exposed to quantifiable trials. Last but not least, CAM therapies are holistic and holism cannot be evaluated by science. However, eliminating the

individual perception and focusing on the physiological influence of products used in CAM therapies may scientifically ground CAM therapies as alternative and complementary approaches to health.

2.4 Physiological and psychological parameters

To understand the benefit an individual can obtain from aromatherapy, a closer inspection into any stress situation that could potentially place an extra load on the individual, both physically and mentally, needs to be conducted. Individuals often identify headaches, overeating or appetite reduction, sleeping irregularities, fatigue, feeling hot, sweaty and flushed, and frequent illnesses due to the debilitation of the immune system as frequent physical ailments during periods of stress (Epel, Blackburn, Lin, Dhabhar, Adler, Morrow and Cawthorn, 2004). Numerous physical stress indicators exist, however, the above-mentioned are the most evident during periods of stress. Stress does not manifest itself only in physical ailments and in most instances the mental ability of an individual is also compromised and is reflected by emotional instability, irritation, anxiety and depression (Hull, 2011).

Mental overload due to stress could cause impairment in an individual's interaction and functioning in the personal, social and work environment (Schwartz, Gerin, Davidson, Pickering, DPhil, Brosschot, Thayer, Christenfeld and Linden, 2003). Most individuals will experience stress overload in all aspects of life; personal, social and work. Anxiety, distress, depression, frustration, forgetfulness, difficulty in obtaining clarity of thought, being accident prone, overreacting, acting irrationally, being hypercritical and irritated and feelings of inadequacy are mental indicators of stress (Hull, 2011). The mental indicators result in a physiological response within the body, as indicated by an elevated heartbeat and breathing rate during periods of stress overload (Hull, 2011).

The stimulation of the sympathetic nervous system, originating in the autonomic nervous system, induces elevated pressure on the cardiovascular system during periods of stress (Dimsdale, 2008). The increased pressure placed on the cardiovascular system by mental stress can potentially become a risk factor for

developing cardiovascular disease, such as hypertension and coronary artery disease (Pickering and Dphil, 2001; Schwartz *et al*., 2003; Epel, Lin, Wilhelm, Wolkowitz, Cawthorn, Adler, Dolbier, Mendes and Blackburn, 2006). The problem arises when an individual's sympathetic nervous system is continuously stimulated by stress and as a result prevents the parasympathetic nervous system from functioning. The parasympathetic system is responsible for slowing down bodily activities and conserving energy as is apparent during sleep. The parasympathetic system can only function properly when the body is relaxed and not dealing with stress (Hull, 2011).

The effects that smell or aromas have on the human being can be physiological and psychological. A physiological effect occurs when there is a direct effect on the physical functioning/parameters of the body, for example, a decrease in body temperature, blood pressure or breathing rate with exposure to essential oils. Psychological effects such as improved self-esteem, concentration and improved capability of rational thoughts and reaction in turn result from the influence of the olfactory system. Psychological effects can also lead to a change in the physiological responses in the body. Therefore, reduction of stress causes stimulation of the parasympathetic nervous system which induces relaxation and consequently normalises blood pressure, breathing rate and any life processes (Hull, 2011). Relaxation could be obtained through the use of sedative essential oils such as Ylang ylang essential oil in aromatherapy (Battaglia, 2003).

Clinical experiments in aromatherapy highlight that the positive effects of aroma molecules are not limited to the inhalation of these molecules, but are also relevantly increased by dermal absorption (Tisserand, 1977). It is generally known that exposure to essential oil molecules lead to physiological and psychological alterations in the human body. A clear distinction can be made between the physiological and the psychological effects even though these effects may occur simultaneously. Currently, existing data regarding the effects of aroma molecules on the human being are vague. The trickiest concept that has arisen through research is that essential oils could have a dual effect simultaneously, namely, sedative and stimulating. These simultaneous effects form a base for confusion when actions such as either sedation or stimulation are used to describe an essential oils functioning. To

compound this problem, a minimal amount of in-depth research exists, preventing the classification of essential oils according to the physiological or psychological effects on the human body (Hongratanaworakit, 2004).

Blood pressure is commonly defined as the pressure which is exerted onto the blood vessels by the circulating blood in the body. Two values that are of importance when dealing with blood pressure are systolic and diastolic blood pressure. Systolic blood pressure refers to the highest pressure exerted on the arteries and this occurs when the heart is contracting, whereas diastolic blood pressure refers to the least amount of pressure exerted, which occurs when the heart relaxes (American Heart Association, 2009). Blood pressure values are always measured in millimeters of mercury (mmHg). A normal blood pressure value for an adult individual who is at rest is 115 mmHg systolic measurement and 75 mmHg diastolic measurement. Systolic and diastolic values are not always constant and can be influenced upon exposure to stress, food intake, medication, physical exertion, disease states, and sometimes even from standing up too fast (Hull, 2009). Research conducted by Hongratanaworakit (2004) indicates that blood pressure is the most frequently assessed physiological variable in research. The blood pressure variable is used as an indicator for general body health and cardiovascular functioning. In a previous study conducted by Hongratanaworakit, Heuberger and Buchbauer in 2002, Ylang ylang essential oil was found to have a homeostatic effect within the body, meaning that Ylang ylang essential oil has a normalising effect on bodily functions. The results of the study indicated a reduction in blood pressure and attention was focused upon exposure to Ylang ylang essential oil (Hongratanaworakit, 2004).

Pulse refers to the heart rate which is indicative of the amount of times at which the heart beats per minute (Essig, 2008; Hull (2009). Heart rate is controlled by the autonomic nervous system, which is comprised of the two branches, sympathetic and parasympathetic nervous systems. In order to control the heart rate for optimal health, a balancing action needs to take place between the sympathetic and parasympathetic nervous systems (Acharya, Joseph, Kannathal, Lim and Suri, 2006). In the case of chronic exposure to stress, an imbalance of the physiological functioning of the nervous system occurs and the imbalance becomes a good

predictor of cardiovascular disease (Schubert, Lambertz, Nelesen, Bardwell, Choi and Dimsdale, 2009). A sleep study conducted in 2004 highlighted that heart rate changes occurring during acute stress could potentially be the cause of disrupted sleep (Hall, Vasko, Buysee, Ombao, Chen, Cashmere, Kupfer and Thayer, 2004). If sleep is continuously disrupted, the body will not recuperate from daily activities sufficiently, thereby resulting in fatigue. The heart rate can be measured at certain strategic points on the body, namely; the neck, at the wrist, behind the knee, the inside of the elbow, and at the ankle (Mulder, 1997). In this research study, the neck (carotid artery) was identified as the site of heart rate measurement.

Without breathing, there is no life as breathing supplies the body with oxygenated air which sustains life (Pitman, 2004). The Hutchinson Encyclopedia and Hinchliff, Norman and Schober (1993) define breathing rate as the amount of times that the lungs expand and contract to fill with air and expel carbon dioxide. This refers to the inhalation and exhalation processes, which form part of the respiration process. Gould (2003) indicates that breathing slowly, deeply and rhythmically aids and enhances a relaxation response from the body which induces the parasympathetic system to obtain homeostasis in the body and counteracts the negative impact of the rapid shallow breathing caused by stress (Online, 2009).

Limited scientific research has been conducted on the impact of aromatherapy essential oils on human physiological parameters. Due to the limitations of the research available, this study was conducted to determine the specific changes that occur physiologically in the body in direct relation to Ylang ylang essential oil application via inhalation and dermal absorption.

2.5 Aim of the research study

The aim of this research study was to investigate practical supportive evidence of specific physiological changes obtained from the use of Ylang ylang essential oil in aromatherapy treatments.

Chapter 3
Methodology

3.1 Introduction

The objectives identified for this research study were three-fold. Firstly, to obtain quantitative demographic data regarding a participant's age, marital status, offspring, employment and stress status. The second objective of this research study was to qualitatively determine the physiological changes in blood pressure, heart rate and breathing rate, whereby essential oil treatments were compared to non-essential oil treatments. The third objective was to determine quantitative information regarding socio-psychological changes such as energy, stress, concentration and patience levels, sexual drive and self-esteem perceptions.

3.2 Study location

The study took place in three cubicles at the Prosperitas Sleep Laboratory at the Central University of Technology, Free State (CUT)'s Bloemfontein campus. The first cubicle had two windows covered by blinds. The second cubicle had one window covered by blinds. The third cubicle had no window. All three cubicles were equipped with air-conditioning to provide a comfortable treatment area. All cubicles had the doors closed, lights switched on and a bed on which the participant was able to lie in a supine position for the duration of the practical sessions. Separate cubicles were utlised to prevent interaction amongst participants which may have prevented reliable and valid physiological parameter measurements.

3.3 Study design

A single blind, experimental case-control study design was followed.

3.4 Study lay-out

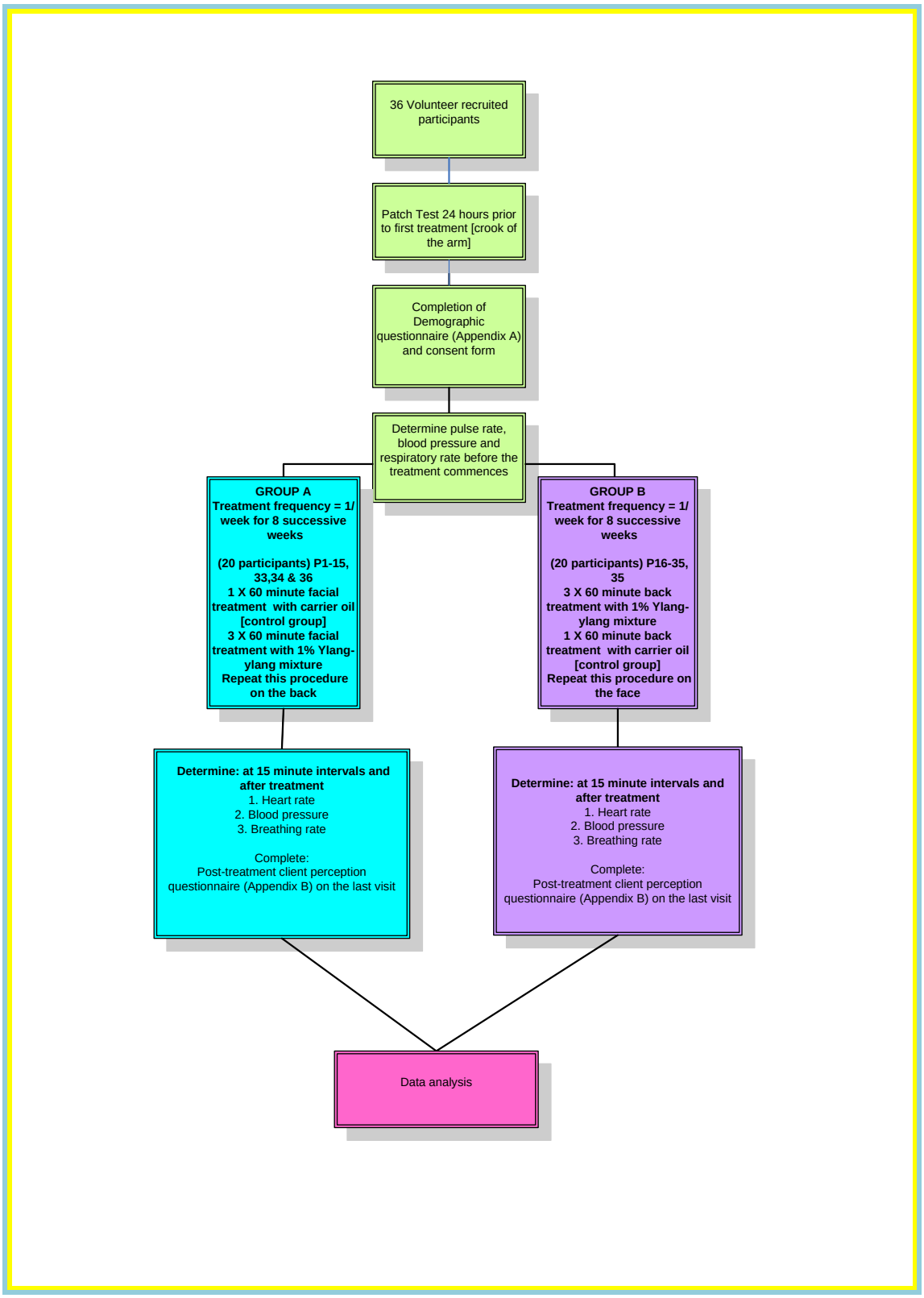

Fig. 3.1: Schematic representation of research study lay-out

3.5 Study population

3.5.1 Number of participants

This research study recruited 36 voluntary female participants from the Bloemfontein area between the ages of 20 - 45 years. This specific age group was identified, as most women would be engaged in the work force during this time frame. This age group also eliminates any hormonal influences that could have occurred during puberty or menopause.

3.5.2 Subject identification

Participants were allocated a participant number between P1 – P36. Participants were allocated numbers according to when they started with their initial practical treatment.

3.5.3 Inclusion criteria

The inclusion criteria for this study were:

- Women must be between the ages of 20 and 45 years;
- No incidence of high or low blood pressure in the women;
- Individuals who have given consent for the study to be conducted; and
- Individuals that had a negative result to the patch test of Ylang ylang essential oil. A negative reaction indicates that the individual did not have an allergic reaction to Ylang ylang essential oil.

3.5.4 Exclusion criteria

The exclusion criteria for this study were:

- Male individuals;
- Hyper or hypotensive individuals;
- Pregnant women;
- Lactating women;
- All individuals on blood pressure medication;
- All individuals on dietary restrictions;
- All individuals on diet aids;
- Individuals on anti-depressant medication;
- Individuals on anti-stress medication;
- Individuals on cardiovascular medication; and
- Individuals who had a positive result from the patch test. A positive reaction was indicated by redness, inflammation and itchiness. These reactions indicate that the individual had an allergic reaction to Ylang ylang essential oil.

3.6 Research activities

3.6.1 Pilot study

A pilot study was conducted on five voluntary participants. The demographic and post-treatment questionnaires (Appendix A and B), designed by the researcher, were distributed to the participants. Changes were made according to suggested recommendations regarding the understanding of questions set out in the pilot questionnaires. Furthermore, two practical sessions were conducted with each of the five voluntary pilot participants in order to determine an adequate time frame to base the main study on.

3.6.2 Recruitment

Thirty six voluntary, female participants from the Bloemfontein area were recruited. The recruitment of participants was based on the convenience-sampling method. Furthermore, any individual who may have become aware of the study from other participants were considered for inclusion. All participants had to fulfil the inclusion criteria of the study.

3.6.3 Patch test

Participants had to provide written consent to partake in the research study. Once consent was given, a patch test was conducted 24 hours prior to the commencement of the initial treatment. One drop of Ylang ylang essential oil was added to one teaspoon (5 ml) of grape seed carrier oil. The patch test mixture was applied to the area inside the crease of the elbow. The patch could be covered or left open, but not washed off, for a period of twenty four hours after application. After 24 hours had elapsed, the participants ascertained telephonically if any reactions to the patch test occurred. A negative reaction to the patch test was indicated by no visible alterations on the skin. A positive reaction to the patch test resulted in one or more of the following: inflammation of the skin where the essential oil was applied, and/or redness and accompanying itchiness. If an individual had a positive reaction to the patch test, it was of utmost importance to thoroughly remove all the essential oil from the skin. Upon removal of the irritating essential oil, the application of aloe vera soothing gel was recommended to neutralise the allergic reaction. No participants experienced a positive reaction to the patch test.

3.6.4 Demographic questionnaire

The participants completed a pre-treatment demographic questionnaire (Appendix A), designed by the researcher, in the fifteen minutes allocated before commencing with the initial treatment. This questionnaire was utilised to determine any demographic information that may have affected the research study. An extra fifteen minutes was

allocated to the treatment time to compensate for the extra time required for the completion of the above-mentioned questionnaire.

3.6.5 Sampling of groups and treatment frequency

For the research study, the researcher divided the 36 participants equally and randomly into group A or B. All participants served as the control and the experimental group for this research study. The treatment frequency was as follows: each participant was treated a total of eight times with the scheduling of one treatment per week. Participants were requested to rest for ten minutes prior to treatments. Rest allowed the body's physiological functions to return to a normal value. The first set of blood pressure, heart rate and breathing rate measurements were performed and recorded directly prior to the application of either the grape seed or Ylang ylang essential oil combination. This measurement was performed with every participant, both in group A and B, and with each separate treatment.

3.6.5.1 Group A

The participants in group A started with one internal control treatment, of which only grape seed carrier oil was applied through soft strokes to the facial area for a period of five seconds. The participants were requested to relax for the remainder of this 60 minute treatment. During treatments two to four, the application of the grape seed and Ylang ylang essential oil combination to the facial area took place. Treatment number five served as a control treatment for the back area by means of applying only grape seed carrier oil. During treatments number six to eight, the grape seed and Ylang ylang essential oil combination was applied to the back area.

3.6.5.2 Group B

The participants in group B commenced treatments with the application of the grapeseed and Ylang ylang essential oil combination to the back area from treatments one to three. Treatment number four was the internal control treatment for the back area, of which only grape seed carrier oil was applied to the back area.

Participants relaxed during the entire sixty minute treatment. During treatments number five to seven, the grape seed and Ylang ylang essential oil combination was applied to the facial area. Treatment number eight served as a control for the facial area, using the grape seed carrier oil only.

3.6.6 Oil concentration

A one percent oil blend, utilising 15 drops of Ylang ylang essential oil in 50 ml grape seed carrier oil was used in the research study. To prevent that the size or weight of an individual affected the percentages used, alterations with regard to the mixing of the oils were made. For a participant with a small build (between 50-70 kg), 10 ml grape seed carrier oil with three drops of Ylang ylang essential oil was used. For a participant with an average/medium build (between 71-90 kg), a mixture of 20 ml grapeseed carrier oil and six drops of essential oil was used. For a participant of large build (90 kg and above), a mixture of 30 ml grapeseed carrier oil with nine drops of Ylang ylang essential oil was used.

3.6.7 Post-treatment questionnaire

Once the final treatment was concluded, participants completed a post-treatment questionnaire (Appendix B), designed by the researcher. The post-treatment questionnaire was aimed at obtaining information regarding perceptive social and interactive aspects that may have resulted from the treatments.

3.7 Treatment methods

3.7.1 Ylang ylang essential oil and carrier oil application

For the purposes of this research study, the combination of inhalation and skin absorption was prevalent, to provide the optimum environment in which dermal essential oil absorption would be maximised. The combination of inhalation via the lungs, as well as skin absorption, showed an ideal representation of maximum essential oil functioning, in comparison to the inhalation process only. The oil was

applied to the area, depending on the group and treatment number, with long, sweeping movements for a period of five seconds until it had been spread properly.

3.7.2 Physiological measurements

Participants were in a supine position when the blood pressure and heart rate were measured. The Nihon Kohden station obtained from SSEM Mthembu was used to electronically measure systolic and diastolic blood pressure, as well as heart rate and breathing rate. The participant's upper arm was wrapped in a cuff with the arrow mid-line cuff indicator of the Nihon Kohden placed directly on the brachial artery on the medial side of the upper arm, between the tricep and bicep muscles. The automatic button was pressed in order for the device to start inflating. When the target pressure was obtained, a short 'beep' sound indicated that the measurement had been taken. The device simultaneously displayed the systolic and diastolic blood pressure, indicated by the SYS and DIA symbols which appeared on the device screen. A three-lead Electrocardiogram (ECG) was used for measuring heart rate. Three ECG pads were positioned on the chest of the participant, one below each scapula bone and one on the base of the ribcage.

A trained medical professional supervised the process and signed off on all blood pressure, heart rate and breathing rate measurements that were taken periodically every fifteen minutes. In order to control the exact amount of time between each reading, a stopwatch was used to indicate fifteen minute intervals. Each treatment lasted sixty minutes; therefore, four sets of measurements were taken every fifteen minutes during the treatment time.

3.7.3 Quality control

The environment in which the treatments of the participants were conducted remained as constant as possible. Firstly, the aim was to schedule treatments on the same day of the week, if possible. Care was taken to prevent deviations as far as possible. Furthermore, due to the fact that each participant had a resting period of ten minutes prior to every treatment, deviations were also minimised. The environment

within the cubicles of the Sleep Laboratory remained the same; no alterations were made to the furniture or placement of equipment within the eight weeks of the treatment process.

The procedure, according to which measurements of the heart rate, blood pressure rate and breathing rate were made, remained exactly the same, as the Nihon Kohden was attached to the participants in exactly the same manner each time prior to commencement of treatments. The amount of time between heart rate, blood pressure and breathing rate measurements was maintained as a stopwatch was utilised to minimise any lapses. The above-mentioned factors ensured that the validity and reliability of this research study was maintained.

3.8 Statistical analysis

Data were captured on a datasheet. Data from the datasheet was then captured electronically in Microsoft Excel. All further analysis was conducted by the biostatistician using SAS Version 9.2. Descriptive statistics namely means and standard deviations, were calculated for numerical data. Frequencies and percentages were calculated for categorical data. Analytical statistics, namely the *t*-test was used to compare mean values in different groups as well as mean values for face versus back. The paired *t*-test was used to compare mean differences between control and experimental treatments. The appropriate p-values were calculated and a significance level of 0.05 was used. Statistical data analysis for this research study utilised the Chi-square test, Fischer's exact test and student's *t*-test.

3.9 Ethical aspects and good clinical practice

3.9.1 Safety variables

The project was deemed safe. Standard medical procedures were followed to obtain blood pressure, breathing rate and heart rate. A patch test was conducted to determine whether the participant had an allergic reaction to the Ylang ylang

essential oil. Therefore, only participants that had a negative result to the patch test continued in this research study. The lowest blend percentage of 1% was used to prevent over-treatment by the essential oil.

For the purpose of this research study, dermal absorption and inhalation were identified as the safest methods in order to safely conduct this research because as stated previously the body will eliminate the essential oils through breathing, sweating, feaces and urination. The percentage of the blend of the essential and carrier oil used was controlled and the weakest blend which is considered the safest was applied.

To ensure no irregularities occurred with regard to the affectivity of the grapeseed carrier oil and Ylang ylang essential oils, both oils were purchased from Holistic Emporium CC. Additionally, to avoid further possibility of data corruption, the full volume of grapeseed carrier oil and Ylang ylang essential oils needed to complete this study were ordered simultaneously. This preventative measure ensured that the oils originated from the same batch number and prevented any possible deviations due to production.

3.9.2 Ethical approval

Ethical approval was obtained from the University of the Free State's Ethics Committee and allocated an ECUFS NR 26/2011 reference number (Appendix C).

3.9.3 Premature discontinuation of the study

The research study was not discontinued as neither the researcher, nor study leaders, felt that a participant's confidentiality was breached, or that any unethical procedures or behaviour occurred.

3.9.4 Financial implications to participants

Participants were not monetarily compensated or charged for the treatment.

3.9.5 Withdrawal criteria

Participation in this research study was completely voluntarily. Participants had the right to withdraw from the study at any time, irrespective of the reason(s) for withdrawal. The elimination of a participant from this particular study did not involve any penalty. Any individual that withdrew from this study was treated as a drop-out for the purposes of this study. No participants, however, withdrew from this study.

3.9.6 Subject information and informed consent

All the voluntary participants were informed of the purpose and necessity of the research project, its financial implications and consequences, as well as the adverse effects and the right to withdraw without any effect on them or their researcher-participant relationship. Voluntary participants signed an informed consent form, and received an information sheet that they were allowed to keep.

3.9.7 Good clinical practice

Personal details of every participant in this particular study were kept confidential. The confidentiality of this study is important. On no account during the research were any of the participants' identities made known to any other people, other than to whom the participant gave her consent to.

Chapter 4
Results

4.1 Introduction

The amount of stress an individual experiences may be linked to the amount of responsibilities (marital, children, profession) an individual is loaded with. Chronic stress has the negative consequence of altering the physiology of the human body by over stimulating the sympathetic nervous system. Furthermore, socio-psychological aspects such as energy, concentration, patience and self esteem may be influenced due to exposure to chronic stress. A number of aromatherapy essential oils, including Ylang ylang essential oil, are attributed with sedative properties that could potentially reduce stress.

4.2 Results of the demographic questionnaire

A demographic questionnaire (Appendix A) was designed to obtain quantitative demographic data regarding age, marital status, offspring, employment and stress status from the voluntary participants during the initial practical treatment in the research project. All 36 participants (100%) completed the demographic questionnaire prior to commencement of the first data collection session.

4.2.1 Age distribution of participants

Individuals progressing through subsequent age levels in their life could experience diverse stress loads. Table 4.1 summarises the age distribution of the participants in the research study. The allocation of participants to a group was approached on a first-come, first-served basis until the groups were evenly matched in numbers. Half of the participants (50%) were in the age group 36 years and above. Within this

grouping, most participants (33%) were in the age group 41 to 45 years. Group A had a good representation of the age groups, however, group B's distribution within the age groups was not as evenly distributed as in group A. The majority (39%) of participants in group B fell within the 20 to 24 age group and a further 34% in the 41 to 45 age group. The remaining 27% reflected the age groups between 25 to 40 years.

4.2.2 Marital status of participants

The marital status of an individual could provide a relevant indication of the stress levels, according to marital responsibilities or a lack thereof. Fifty three percent of the participants were married; with 67% in group A and 39% in group B. The remainder of the study population reflected a 39% single status and eight percent a divorced status (Table 4.1).

4.2.3 Offspring status

Women with children could potentially have higher stress levels resulting from the additional load of maternal responsibilities and demands. Table 4.1 indicates the offspring status of the participants who took part in the research study. Of the total study population, 67% indicated that they had children, compared to the 33% with no children. Upon closer inspection of Table 4.1 and with group A and B separately indicated, group A had 78% with children and 22% with no children. Comparatively, group B had a more even distribution of 56% with children and 44% without.

4.2.4 Employment status

The employment status of an individual is relevant for an indication of stress levels. Employed individuals can experience high workplace demands, whereas unemployed individuals face financial stress due to lack of income to provide for themselves and their dependants. The employment status of the entire group was 56%, with group A

Table 4.1: Demographic information of participants

	GROUP A (n=18)		GROUP B (n=18)		Total (n=36)	
	No of participants	%	No of participants	%	No of participants	%
AGE DISTRIBUTION (Years)						
20-24	2	11	7	39	9	25
25-30	4	22	2	11	6	17
31-35	2	11	1	5	3	8
36-40	4	22	2	11	6	17
41-45	6	34	6	34	12	33
MARITAL STATUS						
Married	12	67	7	39	19	53
Single	4	22	10	56	14	39
Divorced	2	11	1	6	3	8
OFFSPRING STATUS						
Yes	14	78	10	56	24	67
No	4	22	8	44	12	33
EMPLOYMENT STATUS						
Employed	14	78	6	33	20	56
Not employed	4	22	12	67	16	44
STRESS LEVEL STATUS						
None	1	6	1	6	2	6
Low	3	17	5	28	8	22
Average	10	56	8	44	18	50
Above Average	3	17	4	22	7	19
High	1	6	0	0	1	3

presenting 78% and group B 33%. Group B had the highest unemployment rate of 67% (see Table 4.1).

4.2.5 Stress level status

An individual's perceived level of stress exposure can potentially indicate physical reactions to stressors which are pertinent to the parameters of this research. Half of the entire group indicated an average stress level. Three percent of participants indicated a high stress level. Seventy one percent of the entire group therefore experienced average to above average stress levels (see Table 4.1).

4.3 Physiological results

The practical research sessions were aimed at measuring the physiological alterations incurred by the female participants upon exposure to Ylang ylang essential oil or the carrier oil alternatively. Data were captured on a data collection sheet in multiple measurements during each treatment session. The measurements recorded on the data collection sheet included pulse rate, systolic and diastolic blood pressure, mean arterial pressure, breathing rate and oxygen saturation levels. The student's *t*-test was applied to analyse the physiological results. Thirty six participants were monitored during data collection.

4.3.1 Face control

No significant differences occurred between the means of group A and group B, at any of the time intervals, with regard to pulse rate ($p = 0.286$), diastolic blood pressure ($p = 0.875$) and mean arterial pressure ($p = 0.970$) for the face control treatment (Figures 4.1A, C and D). Nevertheless, it is interesting to note that the pulse rate baseline of group A and B was 78 and 76 beats per minute respectively. After 60 minutes of treatment, the pulse rate dropped from 78 to 73 beats per minute in group A and from 76 to 70 in group B.

A significant difference occurred in the systolic blood pressure, as illustrated in Figure 4.1B. A significant difference ($p = 0.048$) occurred in the systolic blood pressure at 30 minutes between the means of group A and B. Consequently, the value of the systolic blood pressure of participants in group B was higher initially compared to group A. Group B had a lower systolic blood pressure on average when compared to group A. The average systolic blood pressure dropped to its lowest after 30 minutes for group A and 45 minutes for group B.

The comparison of the breathing rate measurements (see Figure 4.1E) indicates that a significant difference ($p = 0.041$) occurred between the means of group A and group B at the 45 minute time interval. Breathing rate has a direct correlation with oxygen saturation and therefore a significant difference in oxygen saturation was detected at 45 minutes ($p = 0.025$) between groups A and B as shown in Figure 4.1F.

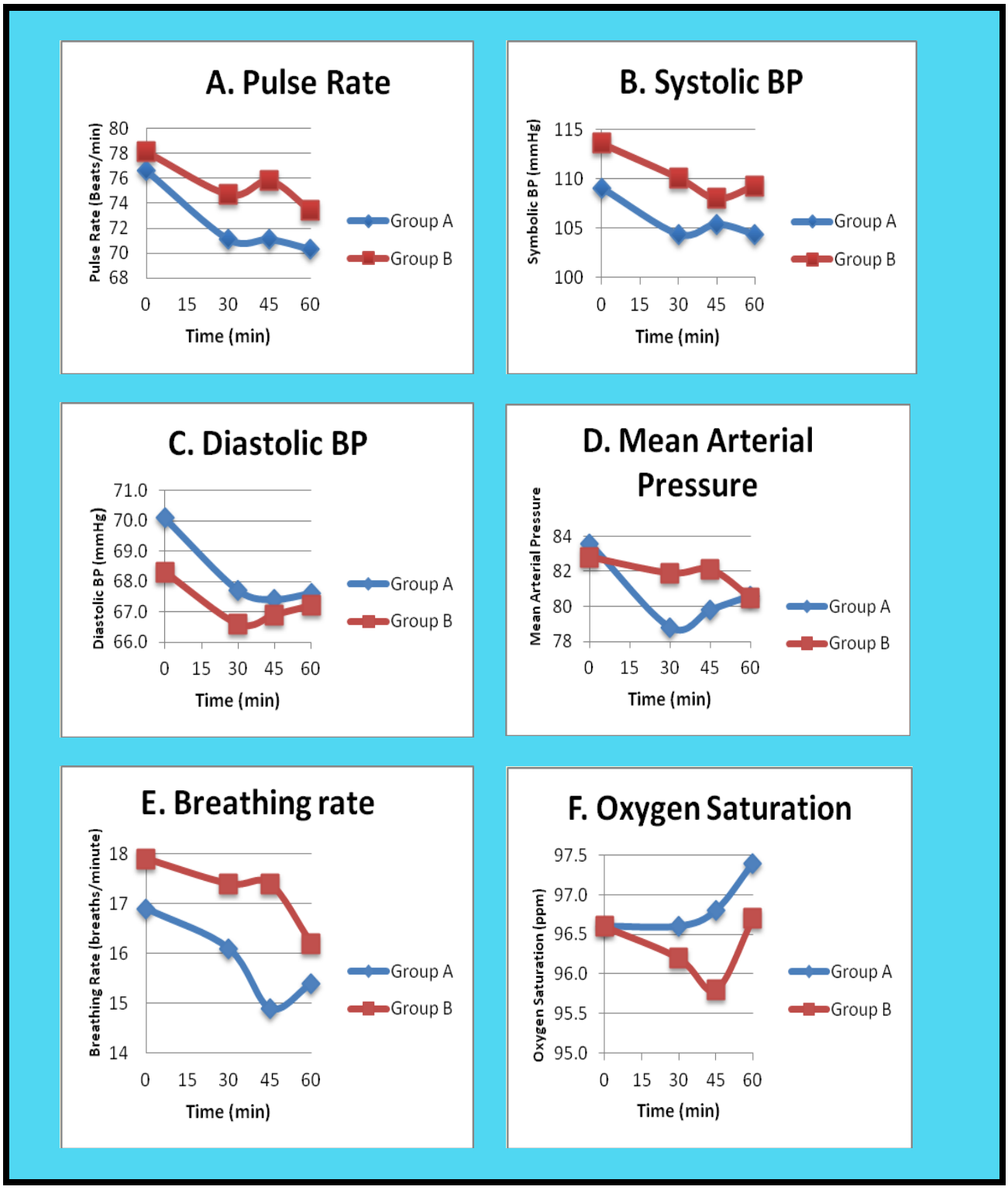

Figure 4.1 (A-F): Summary of the physiological data of the face control of both group A and B (n=36)

4.3.2 Face experimental

Face experimental systolic blood pressure measurements of both group A and B are illustrated in Figure 4.2B. The comparison of the face experimental systolic blood pressure measurements between group A and B yielded significant differences at all stages of the time intervals. At zero minutes there was a difference of $p = 0.000$, at 30 minutes it was $p = 0.010$, at 45 minutes $p = 0.001$ and at 60 minutes $p = 0.003$. The mentioned differences are attributed to the numeric difference of the minimum and maximum values of the face experimental recordings. The majority of participants in group B had higher face experimental systolic blood pressure readings in comparison to the lower levels recorded in group A.

The face experimental diastolic blood pressure measurements of both group A and B at the specified time intervals are exemplified in Figure 4.2C. The sole relevant difference ($p = 0.039$) occurred at 60 minutes when group B presented an elevated diastolic blood pressure.

The face experimental breathing rate measurements of both group A and B are depicted in Figure 4.2E. A significant difference ($p = 0.036$) in the breathing rate between group A and B was detected at the baseline time interval (0 minutes). Participants from group A presented a higher maximum value for breathing rate on commencement of the treatment when compared to the participants in group B. Figure 4.2F illustrates the recorded face experimental oxygen saturation measurements of both group A and B. When comparing the oxygen saturation measurements between the means of group A and group B, a significant difference occurred at zero minutes ($p = 0.018$). The participants from group B had a higher maximum value for oxygen saturation when compared to the participants in group A.

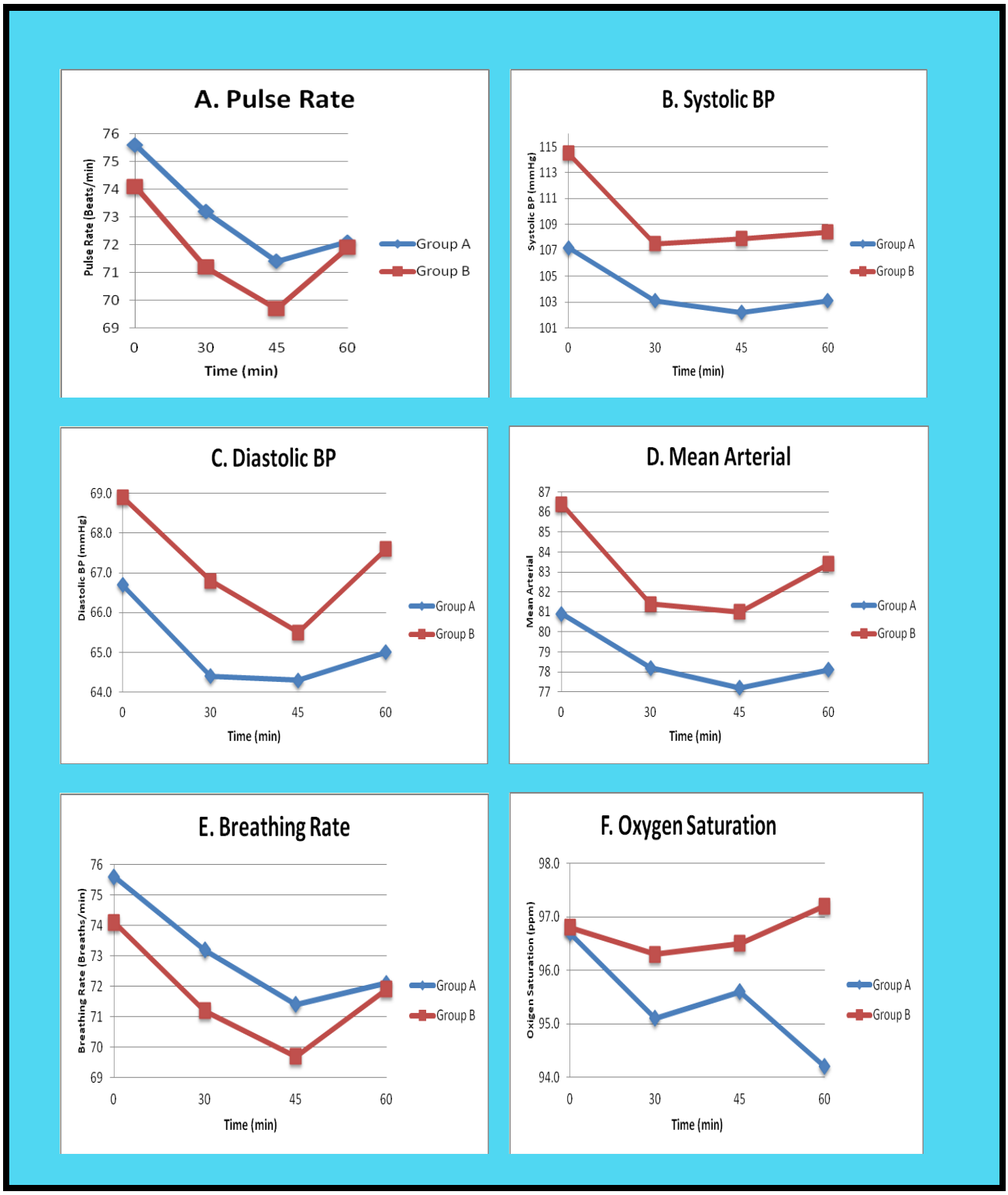

Figure 4.2 (A-F): Summary of the physiological data of the face experimental of both group A and B (n=36)

When focusing on the mean arterial pressure measurements (Figure 4.2D), significant differences occurred at zero minutes ($p = 0.005$), 45 minutes ($p = 0.015$), and 60 minutes ($p = 0.001$). Thus, the only measurement parameter that did not produce relevant differences was the pulse rate ($p = 0.924$) in group A and group B as depicted in Figure 4.2A.

4.3.3 Back control

The comparison of the back control systolic blood pressure measurements between group A and B yielded significant differences which occurred at all stages of the time recording (see Figure 4.3B). At zero minutes a p-value difference of 0.005 existed, at 30 minutes it was $p = 0.003$, at 45 minutes $p = 0.024$, and at 60 minutes a difference of 0.018 occurred. Group B had overall higher systolic blood pressure readings through all time intervals.

The recorded back control oxygen saturation measurements of both group A and B are provided in Figure 4.3F. When comparing the oxygen saturation measurements between the two groups, a relevant difference between the means of group A and group B occurred at 60 minutes ($p = 0.024$). Participants from group A presented higher minimum values for oxygen saturation than participants in group B.

No significant differences between the means of the back control values were indicated at any of the time intervals when the pulse rate ($p = 0.790$), diastolic blood pressure ($p = 0.900$), mean arterial pressure ($p = 0.630$), and breathing rate ($p = 0.340$) measurements were compared. Figures 4.3A, C, D and E show the back control pulse rate measurements of both group A and group B.

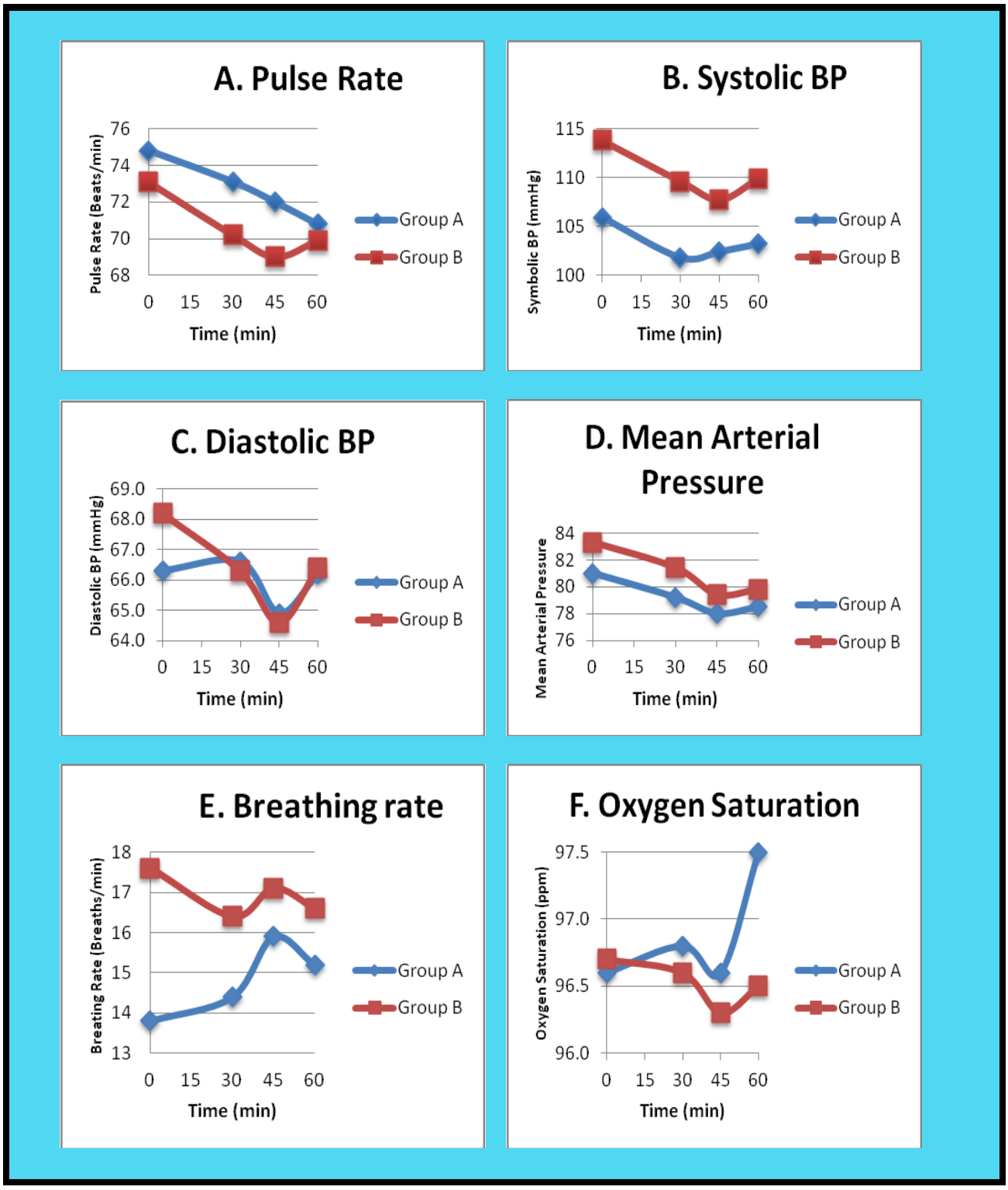

Figure 4.3 (A-F): Summary of the physiological data of the back control of both group A and B (n=36)

4.3.4 Back experimental

The back experimental systolic blood pressure measurements of both group A and B are exemplified in Figure 4.4B. A comparison between group A and B of the back experimental systolic blood pressure measurements yielded significant differences which occurred at zero minutes ($p = 0.017$), 45 minutes ($p = 0.028$), and 60 minutes ($p = 0.019$) of the time recording. Overall higher systolic blood pressure readings were recorded at all time intervals for group B.

The back experimental mean arterial pressure measurements of both groups taken at the indicated time intervals are illustrated in Figure 4.4D. Significant differences of the mean arterial pressure measurements between group A and B were recorded at 45 minutes ($p = 0.022$). Participants in group B had higher back experimental mean arterial pressure readings in comparison to the lower levels recorded in group A.

A comparison of the back experimental pulse rate ($p = 0.400$), diastolic blood pressure ($p = 0.880$), breathing rate ($p = 0.240$), and oxygen saturation measurements ($p = 0.902$) between group A and B indicated that there were no significant differences detected between the means of the back experimental values of group A and B at any time interval (Figure 4.4A, C, E and F).

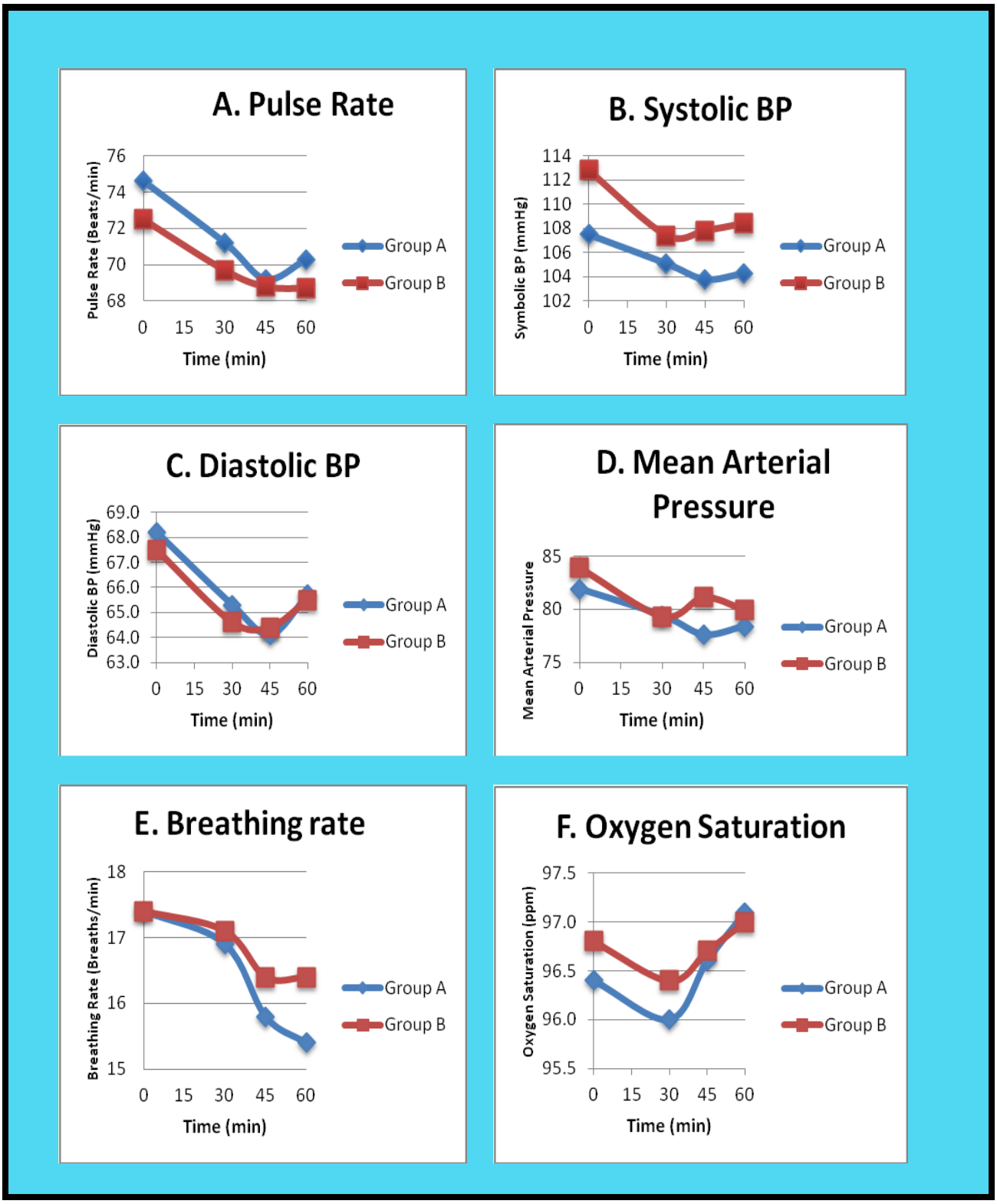

Figure 4.4 (A-F): Summary of the physiological data of the back experimental of both group A and B (n=36)

4.3.5 Face: Control vs. Experimental

The face control vs. experimental systolic blood pressure measurements of both groups are illustrated in Figure 4.5B. A comparison of the face control vs. experimental systolic blood pressure measurements between group A and B yielded a significant difference recorded at 30 minutes ($p = 0.040$). Figure 4.5B reflects lower experimental systolic blood pressure measurements compared to the control systolic blood pressure measurements.

As depicted in Figure 4.5C, the face control vs. experimental diastolic blood pressure measurements of both group A and B revealed a significant difference at 45 minutes ($p = 0.014$) of the time recording. Upon analysis of Figure 4.5C, it is evident that the recorded experimental diastolic measurements were lower than those of the control.

There were no relevant differences in the face control vs. experimental pulse rate ($p = 0.870$), mean arterial pressure ($p = 0.880$), breathing rate ($p = 0.590$), and oxygen saturation ($p = 0.190$) measurements of both group A and group B as depicted in Figure 4.5A, D, E and F.

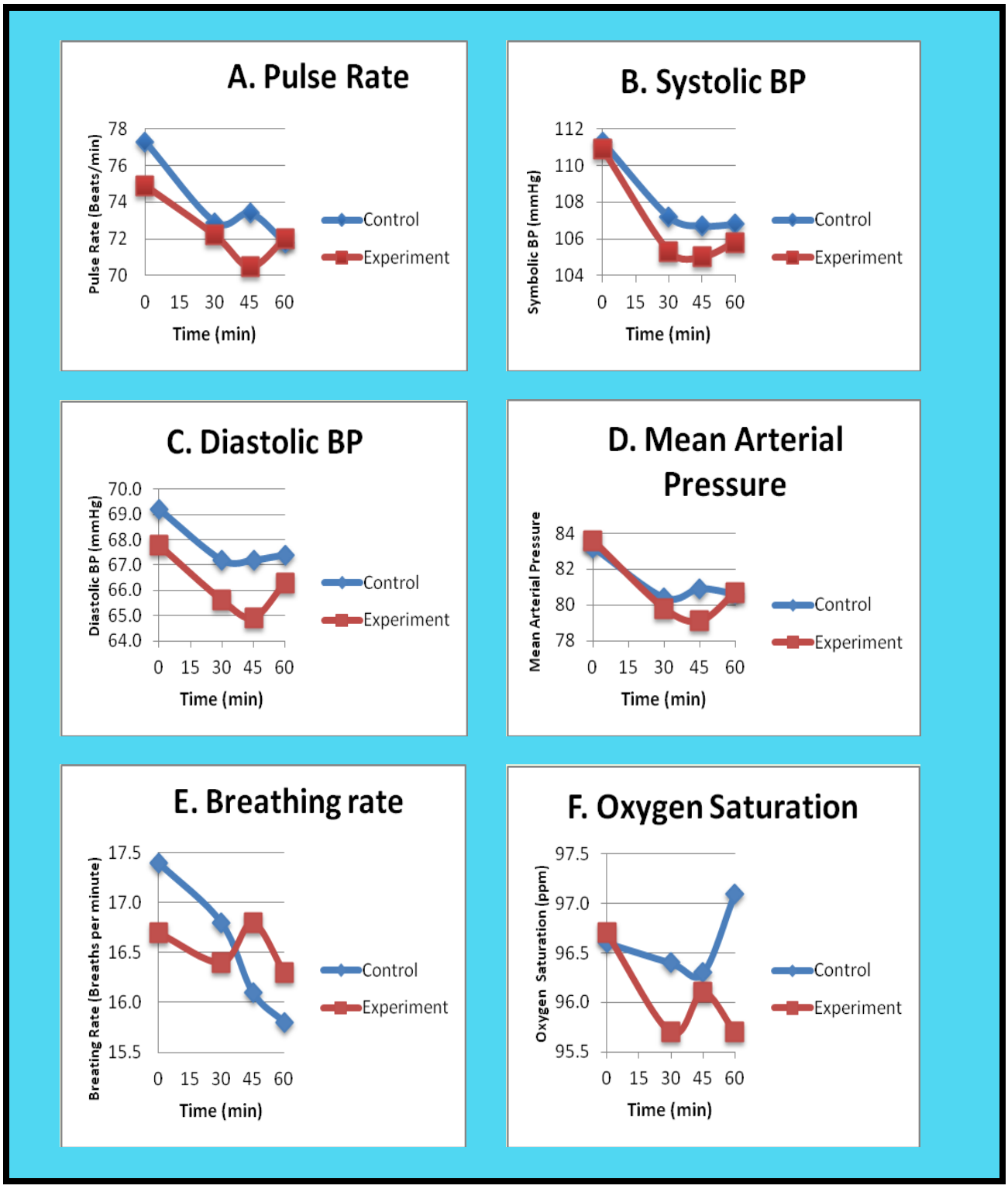

Figure 4.5 (A-F): Summary of the physiological data of the face control vs. experimental of both group A and B (n=36)

4.3.6 Back: Control vs. Experimental

Figures 4.6A, B, C, D and F reveal the back control vs. experimental pulse rate ($p = 0.433$), systolic ($p = 0.472$) and diastolic blood pressure ($p = 0.483$), mean arterial pressure ($p = 0.100$), and oxygen saturation ($p = 0.914$) measurements of both groups. Comparing the above mentioned measurements between the back control and experimental group reflected no significant differences between the mean values of group A and B at any time intervals.

A comparison of the back control vs. experimental breathing rate measurements yielded significant differences which occurred at zero ($p = 0.036$) and 30 minutes ($p = 0.024$) of the time recordings. Figure 4.6E illustrates the back control vs. experimental breathing rate measurements of group A and B.

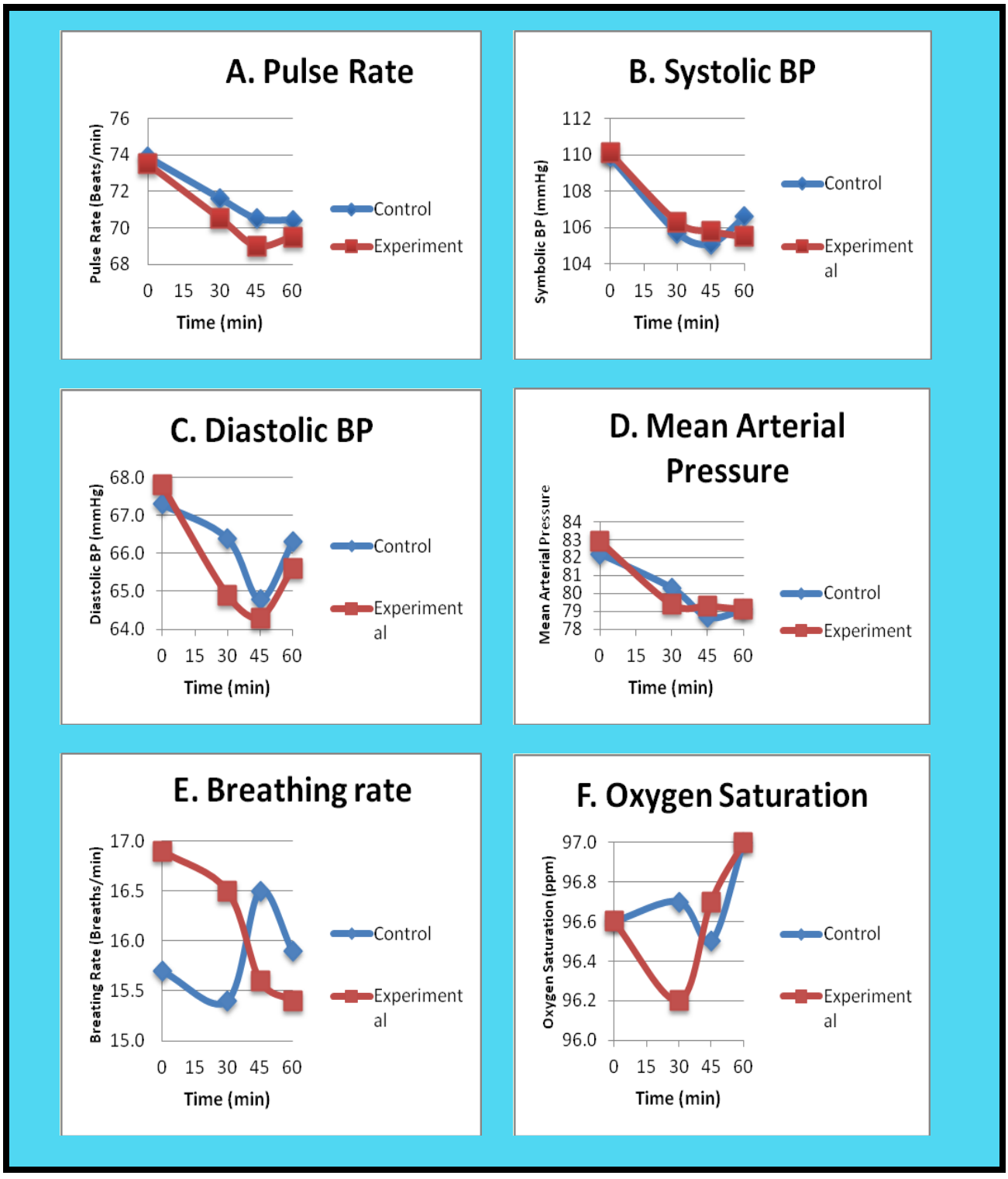

Figure 4.6 (A-F): Summary of the physiological data of the back control vs. experimental of both group A and B (n=36)

4.3.7 Control: Face vs. Back

A comparison of the pulse rate measurements between the control face and back group indicates a significant difference between the mean values at zero minutes ($p = 0.046$) (see Figure 4.7A). Comparison of the baseline (0 minutes) pulse rate measurement reflects 77.3 beats per minute for the face control and 73.9 beats per minute for the back control.

The control face vs. back diastolic blood pressure measurements of both group A and B are highlighted in Figure 4.7C. A significant difference occurred at zero ($p = 0.048$) and 60 minutes ($p = 0.009$) when the diastolic blood pressure measurements of the face control are compared to the back control. The face control diastolic blood pressure measurements were consistently higher and more constant than those of the back control. Comparing the control face and back group breathing rate measurements between group A and B confirms significant differences at zero minutes ($p = 0.014$) and 30 minutes ($p = 0.040$) of the time recording (see Figure 4.7E).

The control face vs. back systolic blood ($p = 0.851$), mean arterial pressure ($p = 0.350$) and oxygen saturation ($p = 0.838$) measurements of both group A and B indicate that no significant difference was noted as illustrated in Figures 4.7A, D and F.

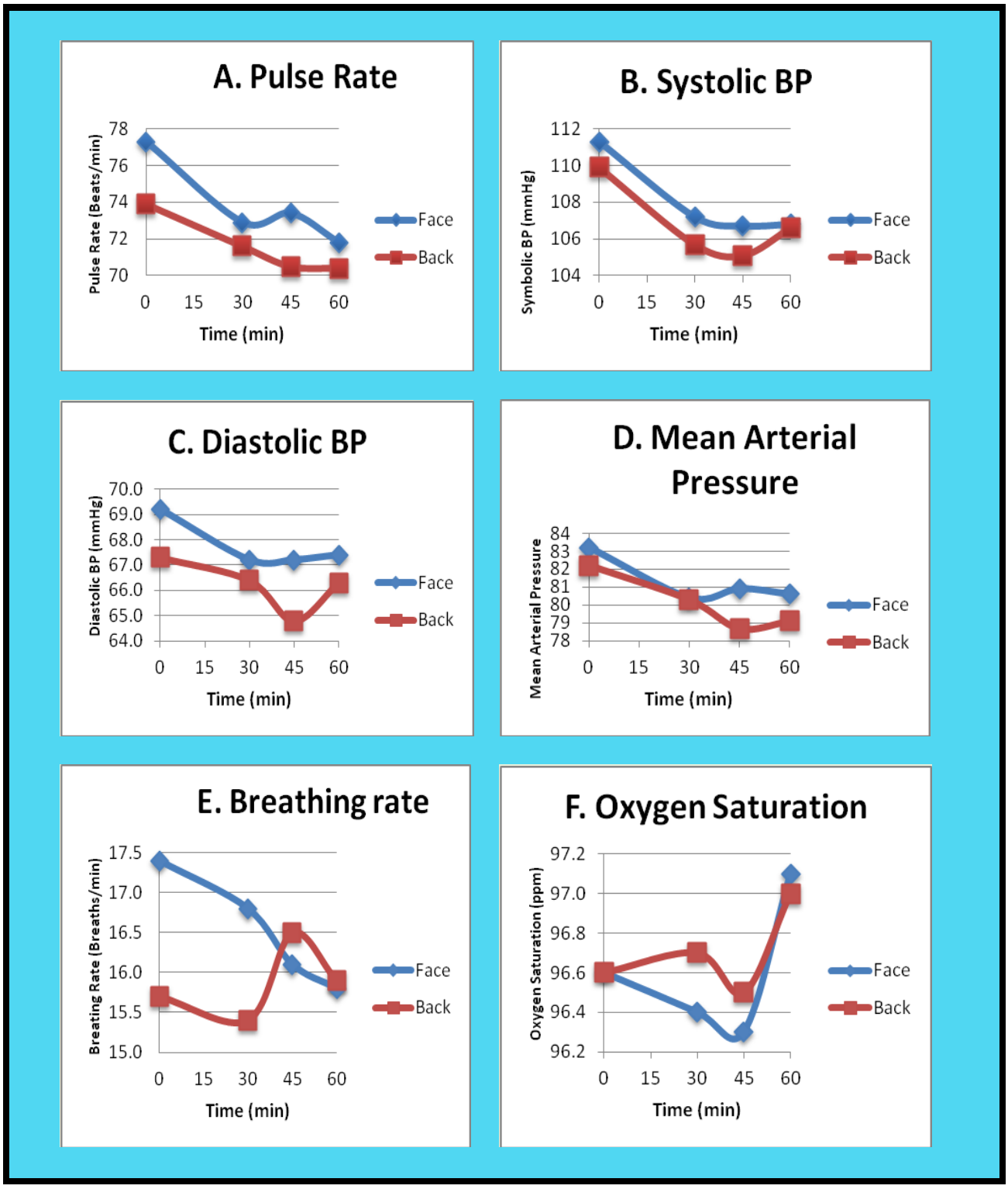

Figure 4.7 (A-F): Summary of the physiological data of the control face vs. back of both group A and B (n=36)

4.3.8 Experimental: Face vs. Back

When comparing the pulse rate measurements between the experimental face and back group, a significant difference occurred at 60 minutes ($p = 0.011$). The experimental face vs. back pulse rate measurements of both groups are presented in Figure 4.8A.

No significant values were detected between the following physiological parameters: systolic ($p = 0.840$) and diastolic ($p = 0.410$) blood pressure, mean arterial pressure ($p = 0.080$), breathing rate ($p = 0.114$), and oxygen saturation ($p = 0.200$) of group A and B (see Figure 4.8B - F).

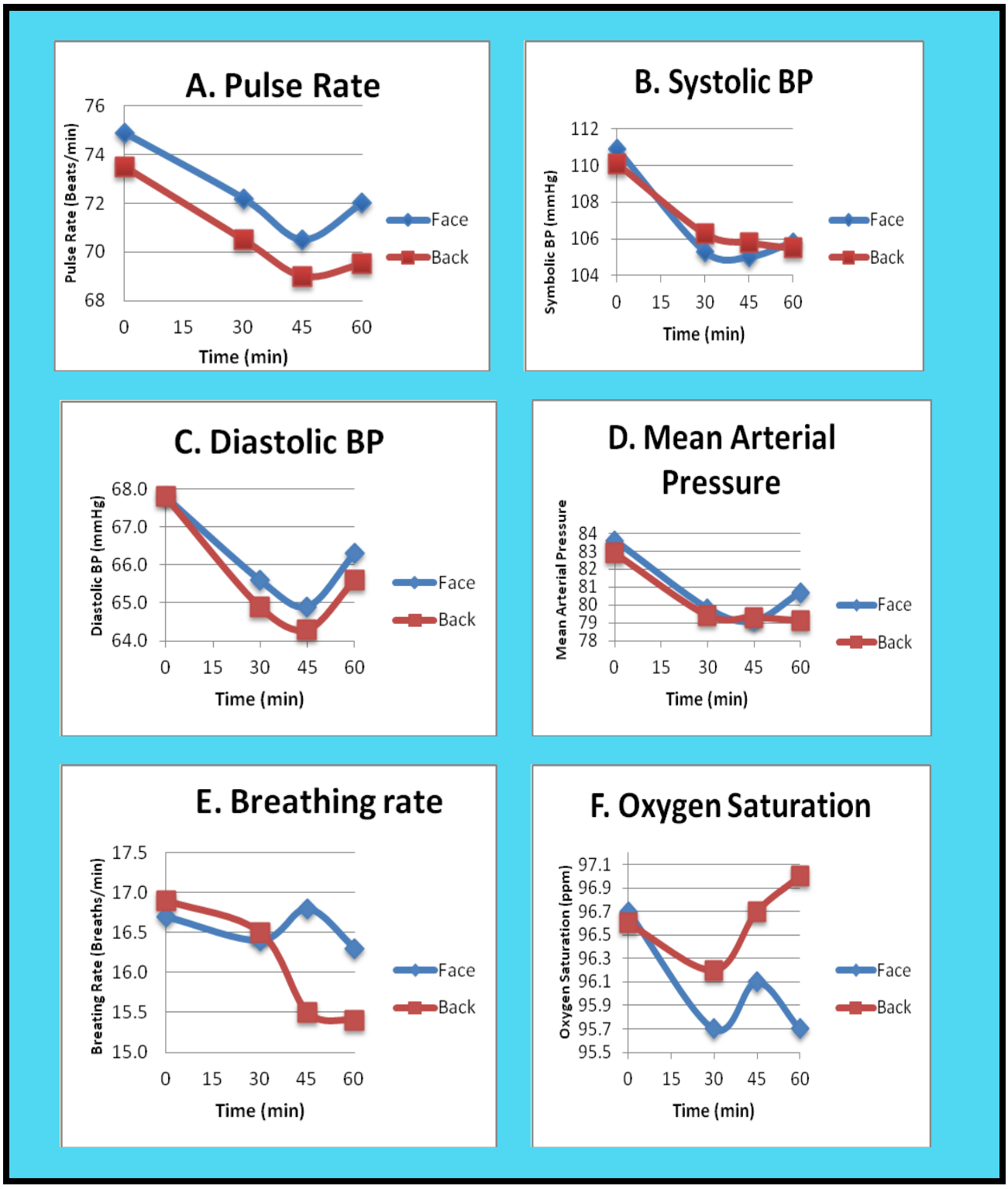

Figure 4.8 (A-F): Summary of the physiological data of the experimental face vs. back of both group A and B (n=36)

4.3.9 Comparison between the baseline and optimal face treatment time (zero minutes vs. 60 minutes)

The face treatment control and experimental pulse rate measurements at zero minutes and 60 minutes are depicted in Figure 4.9A. When comparing the pulse rate measurements between the face control at zero minutes and 60 minutes, a significant difference ($p = 0.010$) existed between the two times. The starting measurement for the face control was 77.3 beats per minute and the final measurement decreased to 71.8 beats per minute. The face experimental commenced with 74.9 beats per minute and reduced to 72 beats per minute. An overall decrease in pulse rate was observed.

Comparing the systolic blood pressure ($p = 0.054$) measurements between the face control at zero minutes and 60 minutes in Figure 4.9B, no significant difference value was indicated between the two times. With respect to the comparison of the face experimental at zero minutes and 60 minutes, there was a significant difference ($p = 0.019$) between the two times that observations were recorded.

Face control and face experimental diastolic blood pressure, mean arterial pressure, breathing and oxygen saturation measurements at zero minutes in comparison to measurements at 60 minutes are summarised in Figures 4.9C, D, E and F. A comparison of these measurements between the face control at zero minutes and 60 minutes indicated that no significant difference ($p = 0.301$, 0.202, 0.109 and 0.360 respectively) occurred between the two times. With respect to the comparison of the face experimental at zero minutes and 60 minutes, there was no significant difference ($p = 0.281$, 0.121, 0.730 and 0.362) between the two times that observations were recorded.

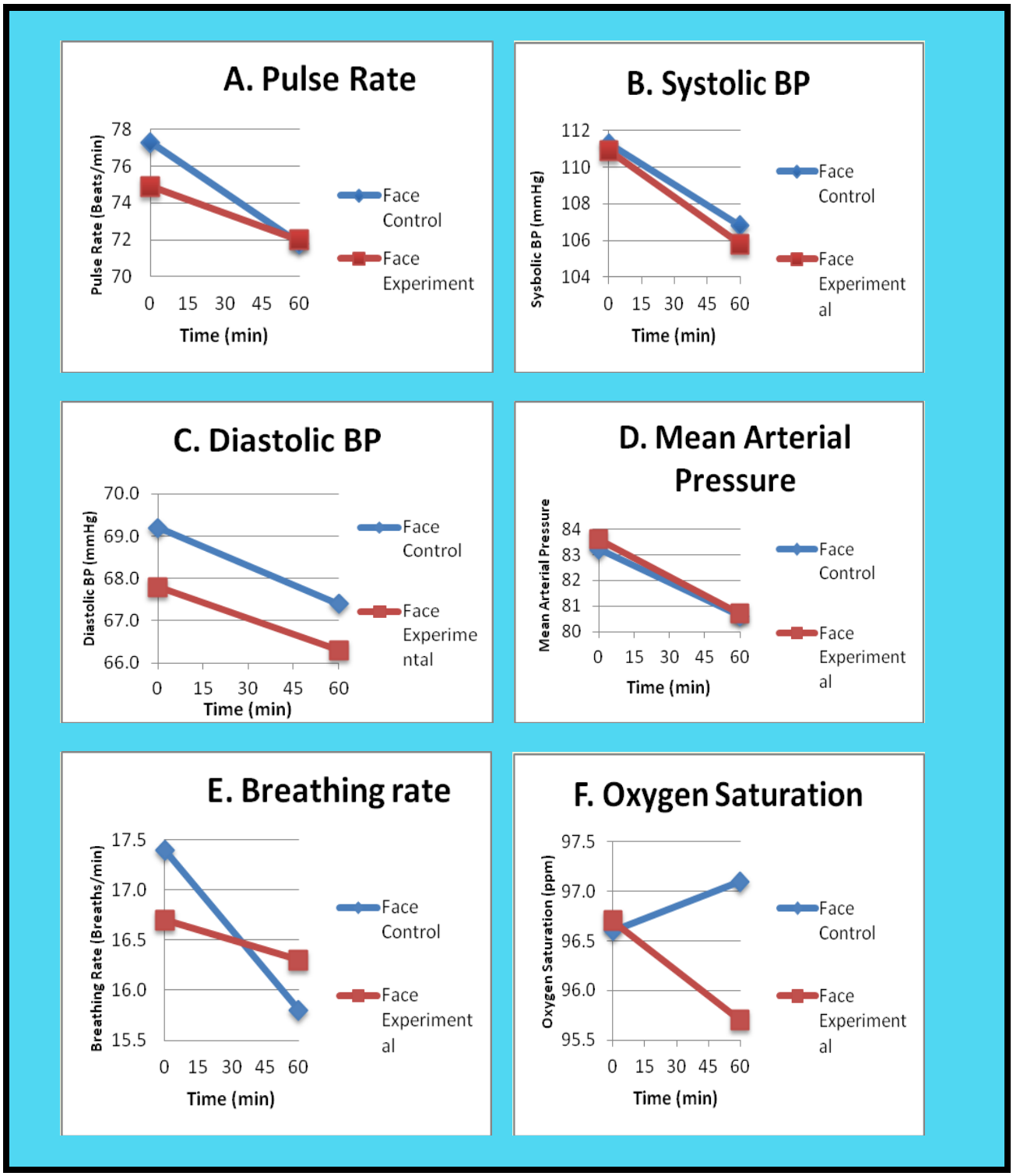

Figure 4.9 (A-F): Summary of the physiological data of the face zero vs. 60 minutes of both group A and B (n=36)

4.3.10 Comparison between the baseline and the optimal back treatment time (zero minutes vs. 60 minutes)

Evaluating the pulse rate measurements of the back control at zero minutes and 60 minutes, no significant difference was indicated between the two time frames. A significant difference ($p = 0.035$) was detected between the baseline and 60 minutes of the experimental group (see Figure 4.10A).

The back control and back experimental mean arterial pressure measurements at zero minutes in comparison to 60 minutes are illustrated in Figure 4.10D. When comparing the mean arterial pressure measurements between the back control at zero minutes and 60 minutes, no significant difference value occurred between the two times. With respect to the comparison of the back experimental group at zero minutes and 60 minutes, there was a significant difference ($p = 0.043$) between the two times that observations were recorded. The mean arterial pressure recording taken at zero minutes decreased when measured again at 60 minutes. The decrease in the experimental group was from 82.9 to 79.1. For the control group, the mean arterial pressure decreased from 82.2 to 79.1.

No significant value differences were depicted in Figures 4.10B, C, E and F which illustrate the back control and experimental groups' systolic and diastolic blood pressure, breathing rate and oxygen saturation measurements at zero minutes compared to 60 minutes.

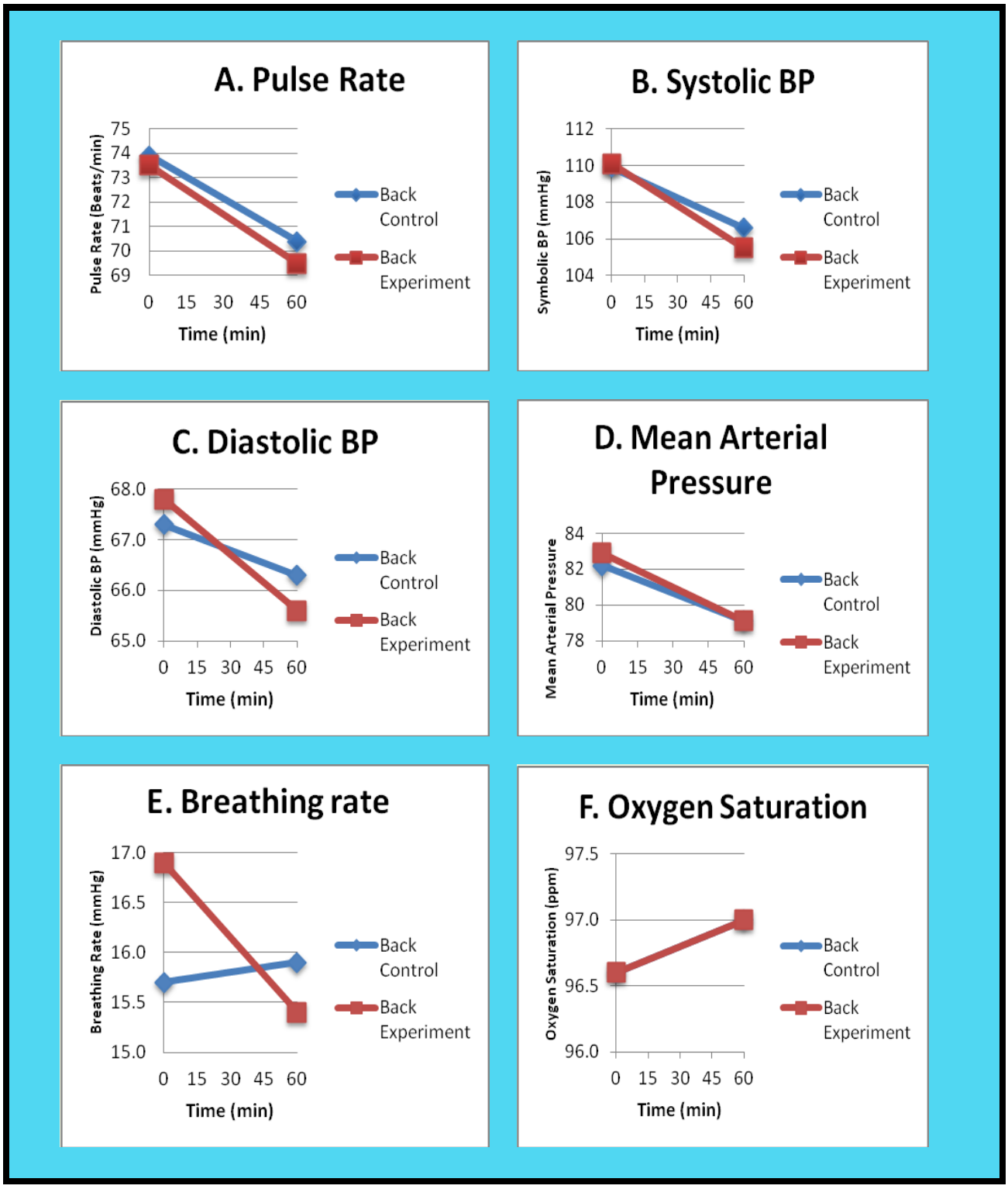

Figure 4.10 (A-F): Summary of the physiological data of the back zero vs. 60 minutes of both group A and B (n=36)

4.4 Results of the post-treatment questionnaire

The post-treatment questionnaire (Appendix B) was formulated to obtain quantitative perceptive data from the participants regarding energy, stress, concentration, sexual drive, patience and self-esteem levels upon completion of the practical treatments. All participants completed the post-treatment questionnaire upon conclusion of the last data collection session. Analysis of the post-treatment questionnaire was conducted using the Fischer's exact test.

4.4.1 Post-treatment energy levels

An increase in energy levels was noted (Table 4.2) by 67% of the participants. Eight percent of the participants indicated a perceived decrease in energy levels. Ten participants in group A and 14 participants in group B indicated an increase in energy levels. Two participants in group A and one participant in group B indicated a decrease in energy levels. Six participants in group A and three participants in group B were not sure of a change in energy levels.

4.4.2 Post-treatment stress levels

The majority (80%) of the participants indicated a decrease in stress levels. Seventeen percent of the participants were not sure whether a change in stress levels existed and 3% indicated an increase in stress levels. One participant in group B indicated an increase in stress levels and no participants in group A indicated an increase. Eighteen participants from group A and 11 participants from group B indicated a decrease in their stress level. Six participants from group B were not sure if a change in stress levels occurred (Table 4.2).

Table 4.2: Post-treatment analysis of the participants

	GROUP A (n=18)		GROUP B (n=18)		Total (n=36)	
	No of participants	%	No of participants	%	No of participants	%
ENERGY LEVELS						
Increase	10	56	14	78	24	67
Decrease	2	11	1	6	3	8
Not sure	6	33	3	16	9	25
STRESS LEVELS						
Increase	0	0	1	6	1	3
Decrease	18	100	11	61	29	80
Not sure	0	0	6	33	6	17
CONCENTRATION LEVELS						
Increase	9	50	14	78	23	64
Decrease	1	6	3	17	4	11
Not sure	8	44	1	5	9	25
SEXUAL DRIVE LEVELS						
Increase	4	23	7	39	11	31
Decrease	3	18	1	6	4	12
Not sure	10	59	10	55	20	57
PATIENCE LEVELS						
Increase	12	67	16	89	28	78
Decrease	2	11	2	11	4	11
Not sure	4	22	0	0	4	11
SELF-ESTEEM LEVELS						
Increase	14	78	12	67	26	72
Decrease	0	0	1	5	1	3
Not sure	4	22	5	28	9	25

4.4.3 Post-treatment concentration levels

The bulk (64%) of the participants indicated an increase in concentration levels. A small portion (11%) of the participants indicated a decrease in concentration levels and the remaining 25% of the participants were not sure if there was a change in their concentration levels. Nine participants from group A and 14 participants from group B indicated an increase in concentration levels. One participant from group A and three participants from group B indicated a decrease in concentration levels. Eight participants from group A and one participant from group B were not sure if there was a change in their concentration levels (Table 4.2).

4.4.4 Post-treatment sexual drive levels

Thirty one percent of the participants identified an increase in sexual drive. A smaller fraction (12%) indicated a decrease in sexual drive, whereas the majority (57%) of participants could not identify whether a change in sexual drive occurred (Table 4.2). Four participants in group A and seven participants in group B indicated an increase in sexual drive. Three participants from group A and one participant from group B identified a decrease in sexual drive and ten participants from both group A and group B were unsure whether a change in sexual drive levels occurred.

4.4.5 Post-treatment patience levels

An increase in the patience levels upon completion of the eight treatments was indicated by the majority (78%) of participants. Eleven percent of the participants indicated a decrease in patience levels and a further 11% were unsure whether a change in patience levels occurred (Table 4.2). Twelve participants in group A and 16 participants in group B indicated an increase in patience levels upon completion of the eight treatments. Two participants from both group A and group B indicated a decrease in patience levels. Four participants from group A and none from group B were aware of a change in patience levels.

4.4.6 Post-treatment self-esteem levels

The largest section (72%) of participants noted an increase in self-esteem levels upon completion of the eight treatments. Three percent of the participants indicated a decrease in self-esteem levels. The remaining 25% of participants were unsure of a change in self-esteem levels. Fourteen participants from group A and 12 participants from group B indicated an increase in their self-esteem levels. With regard to a decrease in self-esteem levels, only one participant from group B indicated a decrease. Four participants from group A and five participants from group B were unsure whether a change in self-esteem had occurred (Table 4.2).

Chapter 5
Discussion and Conclusion

5.1 Introduction

Persistent sporadic stress has been acknowledged as the most predominantly occurring and is generally considered the most probable source of physiological alterations which can impact a human being negatively, due to tissue degeneration (Burchfield, 1979; Pike, Smith, Richard, Hauger, Nicassio, Patterson, McClintick, Costlow and Irwin, 1997; Kemeny, 2003). Stress overload results in physiological responses within the body, as indicated by an elevated blood pressure, pulse rate and breathing rate during periods of stress overload (Hull, 2011). The measuring of the physiological parameters in this study in response to Ylang ylang essential oil contributed to determining whether blood pressure, pulse rate and breathing rate were improved.

A study focusing on gender specific reaction to stress in the United States indicated that women may be more susceptible to stress (Schmaus, Laubmeier, Boquiren, Herzer and Zakowski, 2008). The Schmaus study was designed to address the lack of research into specific gender responses to stress. Women who partook in the study displayed a noteworthy elevation in heart rate upon exposure to the holocaust laboratory stressor when compared to male counterparts (Schmaus *et al.*, 2008). The pre- and post-treatment stress level perceptions of participants in this research study contributed to determining whether Ylang ylang essential oil could potentially positively impact the stress levels of participants.

5.2 Demographic status

The marital status of group A[1] was 67%, with an offspring status of 78%, an employment rate of 77.8%, and above average stress levels of 79%. Thirty nine percent of participants in group B[2] were married with an offspring status of 56%, an employment rate of 33.3%, and above average stress levels of 66%. Taking the responsibility profiles of the participants into consideration, it can be argued that the majority of the participants had numerous responsibility stressors possibly resulting in the participants' elevated perceived stress.

All participants in this study (Table 4.1) fell within the childbearing years of a women's life, indicating that the participants have monthly menstrual cycles. Although this research study did not monitor the menstrual cycle of the participants, hormonal changes that occur in the menstrual cycle could also affect stress levels. Duchesne, Tessera, Dedovic, Engert and Pruessner (2011) found an increase in cortisol (stress response) levels in women during the follicular phase of the menstrual cycle. The elevation of cortisol could potentially imply that women are affected monthly with elevated stress levels during the follicular phase of menses during the childbearing years (Duchesne *et al.,* 2011).

In 1995, a study was conducted utilising urine tests to determine whether more cortisol, which is directly linked to stress, was produced as a direct result of marital and offspring status. The study concluded that full-time employed women with children had higher stress levels when compared to employed women with no children (Luecken, Suarez, Kuhn, Barefoot, Blumenthal, Siegler and Williams, 1997). A trend for group A seems possible if one argues that the participants' responsibilities (marital 67%, offspring 78%, employment 78%) could be the cause of an elevated stress status. Whereas, in the case of group B, the high offspring status (56%) in conjunction

[1] Group A – Treat. 1 face control; treat. 2-4 face experimental; treat. 5 back control and treat. 6-8 back experimental

[2] Group B – Treat. 1-3 back experimental; treat. 4 back control; treat. 5-7 face experimental and treat. 8 face control

with the low marital (39%) and employment (33%) status could be mediating an above average stress level due to the lack of a spouse to share the responsibilities in regards to the children and finances. Coombs (1991) emphasised the protective role that a spouse can have on supporting against the physiological and mental impact of stress. Even though both groups had high stress levels, group A's participants might have had more responsibilities in comparison to group B. Therefore, the increased stress load reflected by 79% in group A, compared to the lower stress level indicated by group B (66%), supports the argument that increased stressors lead to higher stress levels in women. It is important to note that the 44% of unemployed participants could be similarly plagued by stress due to a lack of income to financially address their obligations.

To summarise the results of the demographics of this research study, it could be reasoned that the amount of stressors (marital, maternal, employment and work) experienced by woman could potentially impact on the level of stress encountered. The higher the number of stressors that cause an excessive load on the female individual, the lower the stress-handling capability may become, leading to physiological and psychological overload to compensate for the abnormal stress load (Epel *et al*., 2004; Hull, 2011).

5.3 Physiological status

For optimal and precise physiological alteration measurements upon exposure to Ylang ylang essential oil, the research study made use of inhalation and dermal absorption. The inhalation and skin absorption processes took place simultaneously as Ylang ylang essential oil is diffused into the air as an automatic by-product of diffusion and breathed in, as well as being absorbed through the skin. The research study questioned whether dermal application without stimulation of the skin, combined with inhalation was sufficient for Ylang ylang essential oil to have a physiological impact within the human body.

The effects that smell or aroma has on humans can be physiological and psychological. Battaglia (2003) indicated that decreases in body temperature, blood pressure, or breathing rate with exposure to essential oils are examples of such physiological effects.

Significant differences through decreased systolic blood pressure were detected at all stages ($p = 0.000$; $p = 0.010$; $p = 0.001$; $p = 0.003$) of the face experimental group and an overall lower blood pressure occurred in group A and B over the 60 minute treatment period (Figure 4.2B). The significant changes in blood pressure could have resulted due to exposure to Ylang ylang essential oil which may possess sedating qualities to stress-sensitive physiological parameters. The resultant decrease in blood pressure correlates with Hongratanaworakit and Buchbauer (2006) who stated that Ylang ylang essential oil causes significant differences in blood pressure measurements by lowering the blood pressure. At 45 minutes, a significant decreased diastolic difference occurred (Figure 4.5C) in the face experimental group. Based on the extrapolated data, it could be suggested that the presence of Ylang ylang essential oil appeared to have had a greater effect on lowering blood pressure, as opposed to the control carrier oil.

The decreased systolic blood pressure measurements reflected in Figure 4.4B indicated significant differences at zero ($p = 0.017$), 45 ($p = 0.028$) and 60 minutes ($p = 0.019$) for the back experimental group. The significant lowering of blood pressure correlates with Akutsu *et al*. (2006) that the physiological changes that occur on exposure to Ylang ylang fragrance are significant blood pressure and heart rate decreases in human beings. This argument was supported by Battaglia (2003) who stated that the main therapeutic actions of Ylang ylang on physiological functioning are that this essential oil decreases blood pressure and is a general relaxant.

A significant difference occurred in the lowering of the breathing rate ($p = 0.036$) for the face experimental group and this correlates with the decrease in blood pressure (systolic and diastolic).

The pulse rate of the face and back experimental groups were compared and a decreased significant difference in pulse rate occurred at 60 minutes ($p = 0.011$), as shown in Figure 4.8A. The pulse rate of the back experimental was consistently lower than that of the face experimental. The larger decrease in the physiological parameters that resulted in the back experimental group may have occurred due to the larger surface area on which Ylang ylang essential oil was applied. Therefore, one may deduce that a greater amount of Ylang ylang essential oil was absorbed via the back upon completion of the 60 minute treatment. The pores of the pilosebaceous unit/gland found on the back are larger than in the face, thus more sebum, which serves as the affinity factor that binds with aroma molecules of essential oils, is produced on the back. The sebum transports aroma molecules through the dermis and into the blood stream. Once the essential oil aroma molecules are within the bloodstream, the therapeutic effects of an essential oil can take place.

Two key pathways for absorption of essential oils through the skin exist (Battaglia, 2003). The first pathway is directly through the stratum corneum (dead keratinised cells/layer) and the second is through skin appendages, such as hair follicles (including the pilosebaceous unit) and sudoriferous glands. The larger surface area of stratum corneum combined with the increased quantity of sudoriferous glands on the back, when compared to the face, could potentially imply that an accelerated rate of absorption of Ylang ylang essential oil occurred. A potential deduction could be made that the application of Ylang ylang essential oil over larger areas of the skin may produce better physiological results.

Further investigation on the specific impact of Ylang ylang essential oil on the face or the back areas separately with regard to physiological variables that may have occurred were also noted. A significant difference ($p = 0.010$) occurred through a decrease in pulse rate baseline measurement compared to the final measurement at 60 minutes in the face experimental group (see Figure 4.9A). The face experimental comparison of the systolic blood pressure measurements yielded a significant difference ($p = 0.019$) between zero and 60 minutes (see Figure 4.9B). The difference highlights the possible significant lowering impact that Ylang ylang essential oil has on

the systolic blood pressure when exposed to this essential oil, in comparison to the control carrier oil application, where no essential oil was applied. This difference is supported by Hongratanaworakit (2006) who stated that Ylang ylang essential oil causes significant lowering in blood pressure measurements.

A significant difference ($p = 0.035$) was detected in the decreased pulse rate in the back experimental at zero and 60 minutes (Figure 4.10A) and mean arterial pressure measurements ($p = 0.043$) (Figure 4.10D). The significant difference in the pulse rate could be attributed to the application and inhalation of Ylang ylang essential oil, possibly leading to lowering the physiological demand which is supported by Hongratanaworakit and Buchbauer (2004). An elevated pulse rate possibly indicates that the functioning of the cardiovascular system is increased, thus lowering of the pulse rate may relieve the excessive load on the cardiovascular system and promote optimal functioning. A research study conducted by Kim and colleagues (2003) utilised an injection of Ylang ylang essential oil to induce relaxation of the urinary muscle of rat and rabbit bladders. The mean arterial pressure of the rats decreased fleetingly when Ylang ylang essential oil was injected. Similarly, the impact of absorption of Ylang ylang essential oil through the skin could possibly produce a lowering in the mean arterial pressure of humans. Lowering of mean arterial pressure could possibly improve cardiovascular functioning by relieving the excessive work load of the arteries.

The noteworthy result that was highlighted in the analysis of the physiological data was the lowering of the blood pressure. A reduction of blood pressure occurred in the experimental group where Ylang ylang essential oil was present. The back experimental groups produced greater reductions in blood pressure measurements in comparison to the face experimental group.

5.4 Post-treatment status

Sixty seven percent of participants indicated a notable increase in energy levels (see Table 4.2) upon completion of all eight practical sessions. Constant stress leads to a

fatigued body due to endocrine influence resulting from the fight or flight response, thus a reduction in stress levels leads to improved energy levels by reducing the severity of the fight or flight response (Steflitsch and Steflitsch, 2008). Relaxation occurred during Ylang ylang essential oil aromatherapy treatment, resulting in a potential decrease in stress levels and thereby improving energy production within the body.

As depicted in Table 4.2, 80% of the participants acknowledged a decrease in stress levels. Dunn, Sleep and Collett (1995) performed an experimental study on patients in an intensive care unit to determine whether aromatherapy could be useful in reducing stress levels. The study did not produce any relevant differences in the physical stress indicators, however, a perceptive decrease in anxiety levels was reported by patients whom received aromatherapy treatments. The decrease in stress levels in this study could be attributed to the calming and soothing effect of Ylang ylang essential oil, and secondly, to the fact that participants were not interacting with other individuals or activities during the treatments which may have led to a decrease in stress.

A review conducted by Van der Watt and Janca (2008) highlighted that Ylang ylang essential oil elevated the attention capability and vigilance of individuals. Sixty four percent of participants experienced an increase in concentration levels upon completion of treatments (see Table 4.2). The perceived improvement in concentration could probably be attributed to the clarity of thought processes that occurs when stress levels are minimised. A research study performed by Ilmberger, Heuberger, Mahrhofer, Dessovic, Kowarik and Buchbauer (2001) concluded that the impact of essential oils on concentration is primarily psychological in nature and this correlates with the data generated from the research study.

A possible consequence of exposure to stress is diminished patience levels in individuals and heightened hostility (online, 2011; online, 2013). Seventy eight percent of the participants in the research study indicated an increase in patience levels upon the completion of the treatments, as highlighted in Table 4.2. It could be argued that the resultant improvement in perceived patience levels of the participants occurred

because their stress levels (80%) improved and that Ylang ylang essential oil is a general relaxant (Battaglia, 2003).

Seventy two percent of the participants indicated an increase in personal self esteem (see Table 4.2). A controlled clinical pilot study concluded by Rho, Han, Kim and Lee (2006) on elderly Korean women found a significant difference in the self esteem of the participants. Sedative oils such as rosemary, chamomile and lavender were utilised for the study. Given that Ylang ylang essential oil is also classified as a sedative essential oil, it stands to reason that this essential oil could potentially exert the same beneficial improvement on the self esteem of participants. Psychological effects such as improved self-esteem and concentration and an improved capability of rational thoughts and reaction result from the influence of essential oils on the olfactory system (Battaglia, 2003).

Decreased stress levels upon completion of the eight practical sessions was a notable result obtained from the post-treatment data. Improved energy, concentration, patience and personal self esteem levels were also reported.

Combining the results obtained from the pre-treatment questionnaires, the physiological treatments and the post-treatment questionnaires, the following correlations could be highlighted. Seventy two percent of participants indicated average to above average stress levels. The physiological indicators of stress such as elevated blood pressure, increased breathing rate and accelerated pulse rate resulted in improvements of the experimental group and post-treatment analysis of perception indicated that stress levels were possibly reduced in 80 percent of participants over a period of eight weeks. The solitary changes that transpired in the participants' regular routine were the treatments offered in the study which alludes to a potential positive influence in reduction of stress levels through relaxation induced by exposure to Ylang ylang essential oil.

An individual exposed to chronic stress overload could undergo physiological alterations which manifest as increased blood pressure, pulse rate and breathing rate

(Konduru, 2011). Hindrance of the functionality and weakening of the cardiovascular system may result from long term overburdening of this system.

The decrease in functionality and weakening of the cardiovascular system provides a platform for severe life-threatening medical conditions, such as heart attacks, increased cholesterol levels and chronic hypertension (Konduru, 2011). Aromatherapy, specifically Ylang ylang essential oil, could provide an alternative holistic approach for maintaining relaxation through decreased blood pressure, pulse rate and breathing rate.

The lowering of blood pressure is a result of measured and regular breathing rate (Grossman, Grossman, Schein, Zimlichman and Gavish, 2001). A reduction in breathing rate occurred during the experimental group upon exposure to Ylang ylang essential oil (Figures 4.2E and 4.4E). This essential oil could therefore assist with the normalising of breathing rate through relaxation. The lowering of the breathing rate allows for optimal oxygen intake and carbon dioxide expulsion leading to improved body functioning, which leads to a greater resistance to disease.

5.5 Conclusion

Physical stress indicators, such as elevated pulse rate, systolic blood pressure, diastolic blood pressure and breathing rate, which increased during stress, were reduced sooner in aromatherapy treatments where Ylang ylang essential oil was present. Therefore, individuals can benefit from Ylang ylang essential oil exposure even within a restricted time, thus precluding lower incidences of applicability as the treatment requires minimal time which suits most women’s busy schedules.

Most participants experienced average to above average stress levels before any treatment was applied and the higher stress levels correlated with higher work and family responsibilities. Female individuals who were married, had children, and managed a professional career indicated higher perceived stress during this study. Individuals with no income also experienced higher stress levels.

Dermal application of Ylang ylang essential oil produced more prominent improvements when applied to the back area, indicating that a larger absorption surface provides superior improvements in the physical parameters. Consequently, incorporating Ylang ylang essential oil into body creams and in baths will maximise this essential oil's positive effects within the body.

Upon completion of the final treatment, most participants perceived an improvement in stress levels, concentration levels, energy levels and self esteem levels. In general, it seems probable that Ylang ylang essential oil had a positive effect on stress and had a reductive effect on some of the physiological parameters. The first significant reduction and largest effect was detected at 30 minutes upon exposure to Ylang ylang essential oil.

5.6 Limitations

The research study was limited by the lack of a validated subjective questionnaire that might have determined the definite stress levels of the participants which would have contributed to the body of knowledge.

5.7 Prospective recommendations

Future research progression from this study should consider the inclusion of factors:

- A larger population size is recommended due to the fact that a larger regression is possible with a larger population size.
- The inclusion of menopausal women to determine the influence of the menstrual cycle on stress levels.
- The utilisation of portable monitoring machines could possibly be applied in the active work environment and the physical alterations monitored in real life situations. The physiological stress indicators would provide higher validity.

- Validate a subjective questionnaire that could determine the actual stress levels of the participants. Higher validity would be provided by the psychological stress indicators.
- The inclusion of both sexes would provide insight into the differences of how stress is perceived by males and females and highlight the areas of life which the different genders place importance on.

The topic of complementary and alternative therapies is a diverse one. Various opinions, whether justifiable or not, possibly influence the public domain in regards to CAM therapies as alternatives to conventional medicine (Ernst, 2008). The most evident shortcoming in CAM therapy research lies in a lack of scientific research and evidence. Thus, scientific research is required in order to contribute to this field of study by adding knowledge and provide a better understanding of the topic. This research study has contributed to the knowledge of CAM therapy.

REFERENCES

Acharya, U. R., Joseph, K. P., Kannathal, N., Lim, C. M. and Suri, J. S. 2006. Heart rate variability: a review. ***Med Bio Eng Comput***. 44: 1031 – 1051

Akutsu, T., Tanaka, S., Murakami, Y., Nakajima, K. and Nagashima, Y. 2006. Effect of the natural fragrance "cedrol" on dopamine metabolism in the lateral hypothalamic area of restrained rats: A microdialysis study. ***International Congress Series.*** 1287: 196

American Heart Association. 2009. ***Blood pressure.*** Date of Access:23 August 2009
Aromatherapy Science. 2006. The safety issue in aromatherapy. Pharmaceutical Press. 75 – 92

Astin, J. A. 1998. Why patients use alternative medicine. ***American Medical Association***. 279 (19): 1548 – 1553

Barret, B. 2001. Complementary and alternative medicine: What's it all about?. ***Wisconsin Medical Journal.*** 100(7): 20 – 25

Barret, B. 2004. Alternative, complementary and conventional medicine; Is integration upon us? ***The Journal of Alternative and Complementary Medicine***. 9 (3); 417 – 427

Battaglia, S. 2003. **The Complete Guide to Aromatherapy.** Battaglia, S. (ed) 2nd Edition. Brisbane: International Centre of Holistic Aromatherapy. 5, 13, 60, 148, 149, 150, 278, 370 – 373

Battaglia, S. 2009. **Practical guide to chakras and aromatherapy.** Australia: Perfect Potion. 5

Beckmann, H. and Le Quesne, S. 2005. **The essential guide to holistic and complementary therapy**. London: Thomson Learning. 65 – 70, 219 – 226, 281

Boozang, K. 1998. Western medicine opens the door to alternative medicine. **American Journal of Medicine.** 24(2/3): 208 – 212

Buckle, J. 2006. ***Essential oils: Management and treatment of gynecologic infections and stressors***. Sexuality, Reproduction and Menopause, 4:38 - 41

Burchfield, S. R. 1979. The stress response: A new perspective. ***Psychosomatic Medicine.*** 41(8): 661 - 669

Burdock, G.A. and Carabin, I.G., 2007. ***Safety assessment of Ylang ylang (Cananga spp.) as a food ingredient.*** *Science Direct*. 46: 435

Butje, A., Repede, E., & Shattell, M. (2008). Healing scents: An overview of clinical aromatherapy for emotional distress. ***Journal of Psychosocial Nursing and Mental Health Services***, 46(10), 46 - 52

Cho, M., Min, E.S., Hur, M. and Lee, M.S. 2012. Effects of aromatherapy on the anxiety, vital signs, and sleep quality of percutaneous coronary intervention patients in intensive care units. ***Evidence-Based Complementary and Alternative Medicine***. 2013: 1 – 6

Cooke, B. and Ernst, E. 2000. Aromatherapy: A systematic Review. ***British Journal of General Practice***. 50, 493 – 496

Coombs, R. H. 1991. Marital status and personal well-being: A lit review. Family Relations. 40 (1): 97 – 102

Crebbin-Bailey, J., Harcup, J. and Harrington, J. 2005. ***The Spa Book****.* Crebbin-Bailey, J., Harcup, J. and Harrington, J. (eds) 1st Edition. China: Thomson Learning. 139

Cushman, M. J. and Hoffman, M. J. 2004. Complementary and alternative health care and the home care population. ***Sage Journal.*** 16(5): 360 – 373

Dimsdale, J. E. 2008. Psychological stress and cardiovascular disease. ***Journal of American College of Cardiology***. 51(13): 1237 – 1246

Dohms, E. 2010. Psychoneuroimmunology and the implications for the practice of aromatherapy. ***NAHA The National Association for Holistic Aromatherapy***. 15

Duchesne, A., Tessera, E., Dedovic, K., Engert, V. and Pruessner, JC. 2011. Effects of panel sex composition on the physiological stress responses to psychosocial; stress in healthy young men and women. ***Biological Psychology.*** 89: 99 – 106

Dunn, C., Sleep, J. and Collett, D. 1995. Sensing an improvement: an experimental study to evaluate the use of aromatherapy, massage and periods of rest in intensive care unit. ***Journal of Advanced Nursing***. 21(1): 34 – 40

Dusek, J. A. and Benson, H. 2009. A model of the comparative clinical impact of the acute stress and relaxation responses. ***Mind-Body Medicine***. 92(5): 47 – 50

Edris, A. E., 2007. ***Pharmaceutical and Therapeutic Potentials of Essential oils and their individual Volatile constituents: A Review.*** *Wiley InterScience.*

Epel, E. S., Blackburn, E. H., Lin, J., Dhabhar, F. S., Adler, N. E., Morrow, J. D. and Cawthon, R. M. 2004. Accelerated telomere shortening in response to life stress. ***The National Academy of Sciences of the USA.*** 101(49): 17312 – 17315

Epel, E. S., Lin, J., Wilhelm, F. H., Wolkowitz, O. M., Cawthon, R., Adler, N. E., Dolbier, C., Mendes, W. B. and Blackburn, E. H. 2006. Cell aging in relation to stress arousal and cardiovascular disease risk factors. ***Psychoneuroendocrinology.*** 31: 277 - 287

Ernst, E. 2003. A passion for complementary and alternative medicine research. ***Complementary Health Practice Review***. 8(3): 198 – 200

Ernst, E. 2008. How the public is being mislead about complementary/ alternative medicine. ***Journal of the Royal Society of Medicine.*** 101: 528 – 530

Essig, MG. 2008. ***Pulse Measurement.*** http://www.webmd.com/heart-disease/pulse-measurement Date of access: 23 August 2009

ExploreIM. 2013. ***Mind-Body: Defining stress***. http://exploreim.ucla.edu/mind-body/defining-stress/ Date of access: 15 May 2013

Gould, F., 2003. ***Aromatherapy for Holistic Therapies.*** Gould, F. (ed) United Kingdom: Nelson Thornes Ltd. 2 – 4, 26

Grossman, E., Grossman, A., Schein, M. H., Zimlichman, R. and Gavish, B. 2001. Breathing-control lowers blood pressure. ***Journal of Human Hypertension.*** 15: 263 – 269

Gurib-Fakim, A., 2006. ***Medicinal plants: Traditions of yesterday and drugs of tomorrow.*** *Science Direct.* 27: 28

Hall, M., Vasko, R., Buysse, D. Ombao, H., Chen, Q., Cashmere, J. D., Kupfer, D. and Thayer, J. F. 2004. Acute stress affects heart rate variability during sleep. ***Psychosomatic Medicine.*** 66: 56 – 62

Harding, J. 2002. **A guide to essential oils**. United Kingdom: Parragon Publishing.

Harrison, J. 2008. **Aromatherapy: Therapeutic Use of Essential Oils for Esthetics.** Harrison, J. (ed) 1st Edition. New York: Cengage Learning Inc. 205

Hinchliff, S.M., Norman, S.E. and Schober, J. E. 1993. ***Nursing practice and health care.*** Hinchliff, S.M., Norman, S.E. and Schober, J. E. (eds) 2nd Edition. Great Britain: Hodder Headline Group. 124

Hongratanaworakit, T., Heuberger, E., and Buchbauer, G. 2002. ***Influence of Ylang-ylang Oil on Mental, Emotional and Human Physiological Parameters.*** Proc. 33rd International Symposium on Essential Oils (ISEO 2002), Lisbon, Portugal, September 4-7, 2002: 37

Hongratanaworakit, T. 2004. Physiological effects in aromatherapy. ***Songklanakarin Journal of Science Technology***. 26(1); 117 – 125

Hongratanaworakit, T. and Buchbauer, G. 2006. Relaxing effect of Ylang ylang oil on humans after transdermal absorption. ***Phytotherapy Research***. 20: 758 – 763

Howdyshell, C. 1998. Complementary therapy: aromatherapy with massage for geriatric and hospice care – a call for an holistic approach. ***Hosp. J***. 13(3): 69 – 75

Hudson, C.M. 1994. ***Aromatherapy Massage.*** Townsend, H. (ed) 1st Edition. Great Britain: Dorling Kindersley Limited. 6, 11, 14, 39

Hull, R., 2009. ***Anatomy and physiology for beauty and complementary therapies.*** Hull, R. (ed) Cambridge: The Write Idea Ltd. 317, 323

Hull, R., 2011. ***The complete guide to reflexology.*** 1st Edition. Cambridge: The Write Idea Ltd. 23-26

Hutchinson Encyclopedia. 2009. **Breathing rate.** http://encyclopedia.farlex.com/breathing+rate Date of access: 23 August 2009

Ilmberger, J., Heuberger, E., Mahrhofer, C., Dessovic, H., Kowarik, D. and Buchbauer, G. 2001. The influence of essential oils on human attention: Alertness. ***Chem Senses***. 26: 239 – 245

Jenkins, N., 2006. ***Aromatherapy in essence***. Great Britain: Hodder Arnold.

Jones, E., 2009. ***Aromatherapy: A guide to soft tissue therapy***. United Kingdom: Blackwell Publishing Ltd. 163 - 178

Kelly, M.M., Tyrka, A.R., Anderson, G. M., Price, L.H. and Carpenter, L.L. 2008. Sex differences in emotional and physiological responses to the Trier Social stress test. ***Behavior therapy and experimental psychiatry***. 39 (2008): 87 – 98

Kemeny, M. E. 2003. The psychobiology of stress. ***American Psychological Society***. 21: 531 – 554

Kim, H., Yang, H., Kim, D., Kim, H., Jang, W. and Lee, Y. 2003. Effects of Ylang ylang essential oil on the relaxation of rat bladder muscle in vitro and white rabbit bladder in vivo. ***Journal of Korean Medical Science***. 18: 409 – 414

Konduru, L. 2011. ***Biomarkers of chronic stress.*** University of Pittsburgh. 10 - 12

Kumar, S. 2002. The relevance of spirituality in medical profession. ***Indian Journal or Urology***. 18: 207 – 212

Lawless, J., 2002. ***The encyclopedia of essential oils. 2nd Edition.*** Great Britain: Thorsons.

Lis-Balchin, M., 1997. Essential oils and ‘aromatherapy’: their modern role in healing. ***Sage Journals***, 117 (5). 324-329

Luecken, L. J., Suarez, E. C., Kuhn, C. M., Barefoot, J. C., Blumenthal, J. A., Siegler, I. C. and Williams, R. B. 1997. Stress in employed women: Impact of marital status and children at home on neurohormone output and home strain. ***Psychosomatic Medicine.*** 59: 352 – 359

Manner, H. I. and Elevitch, C. R., 2006. ***Cananga odorata (Ylang ylang).*** *Species Profiles for Pacific Island Agroforestry.* 2.1: 7

McGuinness, H., 2003. ***Aromatherapy basics***. 2nd Edition. Great Britain: Hodder Arnold. 2 – 3, 10 – 13, 84 - 85

Mulder, M., 1997. ***Practical guide for general nursing science: Part 2.*** Mulder, M. and Olivier, N.F. (eds) 2nd Edition. South Africa: Kagiso Tertiary*. 46, 47, 56*

Net Industries. 2009. **Respiratory System – Pulmonary Ventilation.** http://science.jrank.org/pages/5846/Respiratory-System-Pulmonary-ventilation Date of access: 23 August 2009

Nordmann, L., 2007. ***Professional Beauty Therapy: The official guide to level 3.*** *Yates, J. (ed)* 3rd ed. United Kingdom: Thomson Learning. 334, 338, 339, 343, 344

Nordmann, L., 2011. ***Professional Beauty Therapy: The official guide to level 3.*** *Yates, J. (ed)* 4rth ed. United Kingdom: Cengage Learning. 399 - 414

Nye, S., 2012. From here to maternity – an introduction to aromatic pregnancy. ***The South African journal of natural medicine (children's corner)***. May 2012. 37

Pham, D.C., Yoo, J.H., Tran, B.Q. and Ta, T.T. 2013. Complementary and alternative medicine use among physicians in oriental medicine hospitals in Vietnam: A hospital-based survey. ***Evidence-Based Complementary and Alternative Medicine***. 2013: 1 – 9

Pickering, T. G. and Dphil, M. D. 2001. Mental stress as a causal factor in the development of hypertension and cardiovascular disease. Current ***Hypertension Reports.*** 3: 249 – 254

Pike, J. L., Smith, T. L., Hauger, R. L., Nicassio, P. M., Patterson, T. L., McClintik, J., Costlow, C. and Irwin, M. R. 1997. Chronic life stress alters sympathetic, neuroendocrine, and immune responsivity to an acute psychological stressor in humans. ***Psychosomatic Medicine.*** 59: 447 – 457

Pitman, V., 2004. ***Aromatherapy: A practical approach.*** Pitman, V. (ed) United Kingdom: Nelson Thornes Ltd. 35, 49, 50, 307

Price, S. and Price, L. 1999. ***Aromatherapy for health professionals.*** 2nd Edition. London: Harcourt Publishers Ltd. 315 – 316

Rho, K.H., Han, S.H., Kim, K.S. and Lee, M.S. Effects of aromatherapy massage on anxiety and self-esteem in Korean elderly women: a pilot study. ***International Journal of Neuroscience***. 116: 1447 – 1455

Schmaus, B. J., Laubmeier, K. K., Boquiren, V. M., Herzer, M. and Zakowski, S. G. 2008. Gender and stress: Differential psychophysiological reactivity to stress reexposure in the laboratory. ***International Journal of Psychophysiology***. 69: 101 – 106

Schmidt, K. and Ernst, E. 2004. Assessing websites on complementary and alternative medicine for cancer. ***Ann Oncol.*** 15: 733 – 42

Schubert, C., Lambertz, M., Nelesen, R. A., Bardwell, W., Choi, J. B. and Dimsdale, J. E. 2009. Effects of stress on heart complexity – A comparison between short-term and chronic stress. ***Biological Psychology.*** 80: 323 – 332

Schwartz, A. R., Gerin, W., Davidson, K. W., Pickering, T. G., DPhil, M. D., Brosschot, J. F., Thayer, J. F., Christenfeld, N. and Linden, W. 2003 Toward a causal model of cardiovascular responses to stress and the development of cardiovascular disease. ***Psychosomatic Medicine.*** 65: 22 – 35

Seo, J.Y. 2009. The effects of aromatherapy on stress and stress responses in adolescents. J Korean Acad Nurs 39(3): 357-365

Steflitsch, W. and Steflitsch, M. 2008. **Clinical Aromatherapy**. 5(1): 74 – 85

Tisserand, R. 1977. ***The Art of Aromatherapy.*** C.W. Daniel, Essex

Van der Watt, G. and Janca, A. 2008. Aromatherapy in nursing and mental health care. ***Contemporary Nurse***. 30: 69 – 75

WebMD. 2011: Stress Management Health Center. ***Stress Management-Effects of Stress***. http://www.webmd.com/balance/stress-management/stress-management-effects-of-stress Date of access: 15 May 2013

Weeks, L., Verhoef, M. and Scott, C. 2007. Presenting the alternative: cancer and complementary and alternative medicine in the Canadian print media. ***Support Care Cancer***. 15: 931 – 938

Wilkinson, S., Aldridge, J., Salmon, I., Cain, E. and Wilson, B. 1999. An evaluation of aromatherapy massage in palliative care. ***Palliative Medicine***. 13(5): 409 – 417

World Health Organisation (WHO). 2006. Dermal absorption. www.who.int/ipcs/features/**2006**/ehc235/en Date of access: 15 May 2013

Zhang, Y., Wu, Y., Chen, T., Yao, L., Liu, J., Pan, X., Hu, Y., Zhao, A., Xie, G. and Jia, W. 2013. Assessing the metabolic effects of aromatherapy in human volunteers. ***Evidence-Based Complementary and Alternative Medicine***. 2013: 1 – 8

APPENDICES

APPENDIX A

Demographic Questionnaire

CENTRAL UNIVERSITY OF TECHNOLOGY, FREE STATE
SENTRALE UNIVERSITEIT VIR TEGNOLOGIE, VRYSTAAT
YUNIVESITHI E BOHARENG YA THEKENOLOJI, FOREISTATA

FACULTY OF HEALTH AND ENVIRONMENTAL SCIENCES

QUESTIONNAIRE: DEMOGRAPHIC INFORMATION

Thank you for your willingness to participate in this study by completing this demographic questionnaire
The questionnaire will take approximately 2 minutes to complete.

Kindly hand back the completed questionnaire on completion of first practical session.

Please note:
* Mark your answer by placing a cross in the appropriate block.
* Please be honest with your answers.

FOR OFFICE USE

1 2

1. AGE CLASSIFICATION

1.	20-24	
2.	25-30	
3.	31-35	
4.	36-40	
5.	41-45	

3 4

2. MARITAL STATUS

1.	Married	
2.	Single	
3.	Divorced	

5 6

3. DO YOU HAVE ANY CHILDREN?

1.	Yes	
2.	No	

7

4. ARE YOU CURRENTLY EMPLOYED?

1.	Yes	

2.	No	

8

5. RATE OF STRESS LEVELS

1.	None	
2.	Low	
3.	Average	
4.	Above Average	
5.	High	

9

Thank you for participating in the completion of this questionnaire.

Please hand in questionnaire to the researcher immediately after completion.

Guida van der Westhuizen

Participant signature: _____

Date: _____

APPENDIX B

Post-Treatment Questionnaire

CENTRAL UNIVERSITY OF TECHNOLOGY, FREE STATE
SENTRALE UNIVERSITEIT VIR TEGNOLOGIE, VRYSTAAT
YUNIVESITHI E BOHARENG YA THEKENOLOJI, FOREISTATA

FACULTY OF HEALTH AND ENVIRONMENTAL SCIENCES

QUESTIONNAIRE: POST-TREATMENT CLIENT PERCEPTIONS

Thank you for your willingness to participate in this study by completing this questionnaire. The questionnaire will take approximately 2 minutes to complete.

Kindly hand back the completed questionnaire on completion to the researcher.

Please note:
* Mark your answer by placing a cross in the appropriate block.
* Please be honest with your answers.

FOR OFFICE USE

1	2

1. HOW WOULD YOU RATE YOUR ENERGY LEVELS ON COMPLETION OF THE TREATMENTS?

1.	Increased	
2.	Decreased	
3.	Not sure	

3

2. HOW WOULD YOU RATE YOUR STRESS LEVELS ON COMPLETION OF THE TREATMENTS?

1.	Increased	
2.	Decreased	
3.	Not sure	

4

3. HOW WOULD YOU RATE YOUR CONCENTRATION LEVELS ON COMPLETION OF THE TREATMENTS?

1.	Increased	
2.	Decreased	
3.	Not sure	

5

4. HOW DO YOU RATE YOUR SEXUAL DRIVE ON COMPLETION OF THE TREATMENTS?

1.	Increased	
2.	Decreased	
3.	Not sure	

6

5. HOW WOULD YOU RATE YOUR PATIENCE LEVELS ON COMPLETION OF THE TREATMENTS?

1.	Increased	
2.	Decreased	
3.	Not sure	

7

6. HOW WOULD YOU RATE YOUR SELF-ESTEEM ON COMPLETION OF THE TREATMENTS?

1.	Increased	
2.	Decreased	
3.	Not sure	

8

Thank you for participating in the completion of this questionnaire.

Please hand in questionnaire to the researcher immediately after completion.

Guida van der Westhuizen

Participant signature: _____

Date: _____

APPENDIX C

Ethical Approval

UNIVERSITEIT VAN DIE VRYSTAAT
UNIVERSITY OF THE FREE STATE
YUNIVESITHI YA FREISTATA

Direkteur: Fakulteitsadministrasie / Director: Faculty Administration
Fakulteit Gesondheidswetenskappe / Faculty of Health Sciences
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Ms H Strauss

2011-03-11

MS GM VAN DER WESTHUIZEN
FACULTY OF HEALTH AND
ENVIRONMENTAL SCIENCES: SOMATOLOGY
CENTRAL UNIVERSITY OF TECHNOLOGY,
FREE STATE
BLOEMFONTEIN
9300

REC Reference number: REC-230408-011

Dear Ms van der Westhuizen

ECUFS NR 26/2011
PROJECT TITLE: EFFECTS OF YLANG-YLANG ESSENTIAL OIL ON PHYSIOLOGICAL AND SOCIO-PSYCHOLOGICAL VARIABLES IN FEMALES.

- You are hereby kindly informed that the Ethics Committee approved the above study at the meeting held on 08 March 2011.

  [Prof WMJ van den Heever-Kriek did not take part in the discussion of this study]

- Committee guidance documents: Declaration of Helsinki, ICH, GCP and MRC Guidelines on Bio Medical Research. Clinical Trial Guidelines 2000 Department of Health RSA; Ethics in Health Research: Principles Structure and Processes Department of Health RSA 2004; Guidelines for Good Practice in the Conduct of Clinical Trials with Human Participants in South Africa, Second Edition (2006); the Constitution of the Ethics Committee of the Faculty of Health Sciences and the Guidelines of the SA Medicines Control Council as well as Laws and Regulations with regard to the Control of Medicines.

- Any amendment, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

- The Committee must be informed of any serious adverse event and/or termination of the study.

- A progress report should be submitted within one year of approval of long term studies and a final report at completion of both short term and long term studies.

- Kindly refer to the ECUFS reference number in correspondence to the Ethics Committee secretariat.

Yours faithfully

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CHAIR: ETHICS COMMITTEE