THE COMPAIRISON OF BIO ELECTRICAL PROPERTIES OF LEECH OIL AND AROMA OIL FOR FOOT REFLOXOLOGY MASSAGE

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ABSTRACT

Massage is one of the techniques for relaxing muscle and to reduce pain. It is use for maintaining condition of body or treats human diseases for thousands of years. Foot massage basically is a massage treatment around calf muscle until underneath foot area where it initiates stimulation to anatomical organs.

In this thesis, the bioimpedance parameters (BI) of people undergoing reflexology therapy are analyzed. A comparison between bioimpedance (BI) parameters of a subject using aroma cream and leech oil is studied. The measurement of bioimpedance parameters is done by using Bodystat Quadscan 4000. The main purpose of this study is to investigate the effect of reflexology in term of resistance (R); reactance (X); impedance (Z); Phase angle; and capacitance (C) of male and female subjects that can be measured as bioimpedance (BI) parameters. All these parameters analyzes by using statistical analysis program called SPSS.

The result showed that there is significant different between the mean of each bioimpedance parameters of massage using aroma and massage using leech oil. The mean of all bioimpedance parameters for massage using leech oil is significantly higher than the mean of the bioimpedance parameters for the massage using aroma cream. It is concluding that leech oil give more beneficial effect to the calf muscle

ABSTRAK

Urut merupakan salah satu teknik untuk berehat otot dan untuk mengurangkan kesakitan. Ia digunakan untuk mengekalkan keadaan badan atau merawat penyakit manusia selama beribu-ribu tahun. Urut kaki pada asasnya adalah satu rawatan urut di seluruh otot betis sehingga mengalir di bawahnya beberapa kawasan kaki di mana ia memulakan rangsangan kepada organ-organanatomi.

Dalam tesis ini, parameter bioimpedance (BI) orang yang menjalani terapi refleksologi dianalisis. Satu comparation antara bioimpedance (BI) parameter tertakluk menggunakan krim aroma dan minyak lintah dikaji. Ukuran parameter bioimpedance adalah dilakukan dengan menggunakan Bodystat Quadscan 4000. Tujuan utama kajian ini adalah untuk mengkaji kesan refleksologi dalam tempoh rintangan (R); regangan (X); galangan (Z); Fasa sudut; dan kemuatan (C) subjek lelaki dan perempuan yang boleh diukur sebagai bioimpedance (BI) parameter. Kesemua parameter ini menganalisis dengan menggunakan program analisis statistik yang dipanggil SPSS.

Hasilnya menunjukkan bahawa terdapat perbezaan yang signifikan antara min setiap parameter bioimpedance urut menggunakan aroma dan urut menggunakan minyak lintah. Min semua parameter bioimpedance urut menggunakan minyak lintah adalah jauh lebih tinggi daripada min parameter bioimpedance yang selama urutan menggunakan krim aroma. Ia menyimpulkan bahawa minyak lintah memberi kesan yang lebih bermanfaat kepada otot betis

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I take this opportunity to express my greatest appreciation to many who have contributed to the completion of this thesis. Without their help, this thesis would not have been written.

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CHAPTER 1: INTRODUCTION

1. Introduction

The origin of "massage" is taken from the Arabic word "mass". The meaning of Arabic word mass is to touch or feel. The massage is a basic physical therapy treatment. It belongs to rehabilitating medicines branch, which adapts all forms of mechanical, electrical, thermal, chemical and radioactive energy for therapeutic purposes (wikii 2006). Evidence of massage for therapeutic purposes can be traced to ancient Chinese, Japanese, Greek and Indian Ayurvedic health practices and was well established as a health-maintaining activity by the Romans. After the decline of the Roman Empire, little was known about its use until "Turkish massage" was reintroduced to Europe through the writings of de Chauliac in the 1300s and Pare' in the 1500s (Scull CW 1945; Kamenetz HL 1985). Interest in the West was heightened after French missionary work in China in the early nineteenth century. Ling in Sweden, followed by Metzger in Holland, as well as Tissot and Georgii in France, spread the use of massage through Europe. "Swedish massage" has grown in popularity; it and other forms of massage are now among the most commonly used complementary medicine interventions (Kamenetz HL 1985).

Massage has been a therapeutic modality used by man since early civilization. (Kamenetz HL 1985) described the origin of the history of massage starting in the early civilizations of Babylon, Assyria, China, India, Ancient Greece and Rome. Massage continued to be used in the middle ages, the Renaissance, and through to the 20th century. It was mainly in the last quarter of the 19thcentury that massage began to be studied and researched, while the 20th century saw the

development of new techniques and systems. (Kamenetz HL 1985) concluded that massage had declined over the greater part of the 20th century and proposed three reasons for this decline:

1. The development of the pharmaceutical industry.
2. New machines supplanted older forms of physical therapy.
3. Dehumanization in the relationship between therapist and patient.

(Scull CW 1945) advocated the use of massage as an 'indispensable agency' in the control of significant features of diverse syndromes such as poliomyelitis, anemia, arthritis and nervous conditions. The physiological basis for these techniques was speculative. It was also noted that the nucleus of physical therapy of rest, massage, heat and exercise had not changed over many years except for the use of X-rays and radium and that massage should be administered by a person of technical skill with anatomical, physiological and pathological knowledge. Whereas, the use of massage advocated by Scull has all but disappeared from use in hospital physiotherapy departments, the use of massage for the sports person has maintained a high profile and is an integral part of an athlete's conditioning even though its role may have been partially overvalued (Kuprian W 1981). From a scientific viewpoint, however, the use of massage in the sporting context has become contentious and flaws have been found in the claims by workers in the early part of the 20th century.

1.1 Research Problem and Problem Statement

Everywhere in the world most of the population is used to take massage for relaxation, but there is no particular scientific proof for this. In this analysis, the muscles active of patients will be measured in a scientific and quantitative way, and the results are analyzed.

1.2 Objective

1. Body composition data need to be measured and represent before and after foot massage between aroma oil and leech oil.

2. By using statistical tools need to analyse the result of body composition of the patient's before and after massage.

1.3 Hypothesis

1. Foot Reflexology treatment will have more changes on body composition by using leech oil.

2. Effectiveness of Foot Reflexology treatment can be represented quantitatively.

1.4 Scope of Study

Scope of this study is restricted to mix population patient that undergo the foot massage treatment some do massage weekly bases some first time do massage, are measured.

1.5 Significance of the Study

There is faith that massage is effective in relaxing but no more scientific proofs have been done. In this analysis measurement of the effects of foot massages before and after is done and also measures the difference by using different oil.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The origin of "massage" is taken from the Arab "mass". The meaning of Arab mass is to touch or feel. The massage is a basic physical therapy treatment. It belongs to rehabilitating medicines branch which adapt all forms of mechanical, electrical, thermal, chemical and radioactive energy for therapeutic purposes (wikii 2006). The Massage can be defined as the soft tissues manipulations of the body performed with the hands for producing relief on the vascular, muscular and nervous systems of the body.

Many techniques of massage have been developed by massage therapist during the last decades. All these techniques are related with ancestral knowledge. The aim of all the massage techniques development is to provide heals to human body and they have achieved great success with this. Normally, Massage is used for dealing to pain and ages.

2.2 Massage History

Evidence of massage for therapeutic purposes can be traced to ancient Chinese, Japanese, Greek and Indian Ayurvedic health practices and was well established as a health-maintaining activity by the Romans. After the decline of the Roman Empire, little was known about its use until "Turkish massage" was re-introduced to Europe through the writings of de Chauliac in the 1300s and Pare' in the 1500s (Scull CW 1945; HL 1985; Kamenetz HL 1985) Interest in the West was heightened after French missionary work in China in the early nineteenth century. Ling in Sweden, followed by Metzger in Holland, as well as Tissot and Georgii in France, spread the use

of massage through Europe. “Swedish massage” has grown in popularity; it and other forms of massage are now among the most commonly used complementary medicine interventions (Kamenetz HL 1985).

Massage has been a therapeutic modality used by man since early civilization. (Kamenetz HL 1985) described the beginning history of massage. According to him massage started in the early civilizations of Babylon, Assyria, China, India, Ancient Greece and Rome. Massage continued to be used in the middle ages, the Renaissance, and through to the 20th century. In the early 19th century, medicine and science made great progress in a desire for greater accuracy, understanding and the questioning of established doctrine. It was mainly in the last quarter of the 19thcentury that massage began to be studied and researched, while the 20th century saw the development of new techniques and systems. (Kamenetz HL 1985) concluded that massage had declined over the greater part of the 20th century and proposed three reasons for this decline:

1. The development of the pharmaceutical industry.
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integral part of an athlete's conditioning 3 even though its role may have been partially over valued (Kuprian W 1981). From a scientific viewpoint, however, the use of massage in the sporting context has become contentious and flaws have been found in the claims by workers during the beginning part of the 20th century.

2.3 Types of Massage and how it is performed

There are many types of massage and techniques are used in the world. The main professionals that provide massage include massage therapists, athletic trainers, physical therapists and practitioners of many traditional Chinese and other eastern medicines. Massage practitioners work in a variety of medical and recreational settings and may travel to private residences or businesses (wikii 2006). Contraindications to massage include deep vein thrombosis, disorders or taking blood thinners such as Warfarin, damaged blood vessels, weakened bones from cancer, osteoporosis, or fractures, bruising, and fever (wikii 2006). The many techniques of massage have been developed by massage therapist during the last decades. All these techniques related with ancestral knowledge. The aim of all the massage techniques development is to provide heals to human body and they have achieved great success with this. Normally, massage is used for dealing with pain and ages. The main types of massage are described below:

2.3.1 Breema Massage

Breema Massage is also known as partner of yoga and Thai massage. In this type of massage the body and mind are intended to bring together without involving strong exertions or muscular contortions (Pendergrast 2002). This massage is harmonizing method which includes nine Harmony principles (Frey 2006).

2.3.2 Champissage massage

Champissage is also known as Indian Head massage. The word Champi is Hindi word meaning practice or massage. It is a trademarked term for an alternative medicine massage therapy. In this type of massage, the portions of body considered for massage are head, neck and face. The aim of considering these parts of body is to clear blocks in these energy channels which cause a build-up of negative energy result in producing ailments. The main reason for this is that when the energy does not flow properly from these parts of body, negative energy builds up causing ailments, stress, pain, nociception pains, aches, and hair loss. This massage is used all over Europe. This type of massage is very much popular so it increases the income of beauty stall and salon owners (Times Online London 2005).

2.3.3 Barefoot Deep Tissue Massage

Barefoot deep tissue is popularly called as barefoot sports massage. This massage is a blend of Eastern barefoot techniques, such as barefoot Shiatsu massage, coupled with a Western manual medicine, encompassing deep tissue (wikii 2005).

2.3.4 Deep Tissue Massage

A special type of massage usually recommended for an athlete is Deep tissue massage, because this massage has the ability that it can relieve severe tension in the muscle and the connective tissue. Deep Tissue Massage normally applied on the muscles located below the surface of the top muscles. Deep tissue massage is also recommended for individuals who experience consistent pain or patients who have sustained physical injury (Kunz 1993).

2.3.5 Foot Massage

Foot massage is very famous all over the world. It has been practiced for thousands of years in different parts of the world. The history of Foot massage has been recently confirmed by widely reported discovery by an ancient Egyptian wall drawing made in 2330 BC where the practice of hand and foot reflexology is depicted. Foot massage has many types one of its type is reflexology, has gained popularity in many countries such including United States, United Kingdom, China, and Japan.

The reflexology is defined by Oxford Concise Medical Dictionary, as a complementary therapy which is based on the discovery that “reflex” points on the feet has relation with other parts of the body, when high pressure is applied on the suitable reflex points through thumb or fingers. William H. Fitzgerald, M.D introduced Reflexology in the United States in 1913. It was modified by Eunice D. Ingham during 1930s and 1940s. She claimed that the feet and hands were especially sensitive, and mapped the entire body into "reflexes" on the feet renaming "zone therapy" to reflexology. Her theories are famous within the United States and United Kingdom.

Reflexology, or zone therapy, is an alternative medicine involving the physical act of applying pressure to the feet, hands, or ears with specific thumb, finger, and hand techniques with or without the use of oil or lotion. Reflexologists claim that it is based on a system of zones and reflex areas that reflect an image of the body on the feet and hands, with the principle that such work effects a physical change to the body (Kunz 1993). However there are contradicting reports too. A 2009 systematic review of randomized controlled trials concludes that "The best evidence available to date does not demonstrate convincingly that reflexology is an effective treatment for any medical condition (Ernst E 2009).

There is no definitive way or explanation among reflexologists on how reflexology is supposed to work; a unifying theme is the idea that areas on the foot correspond to areas of the body, and that by manipulating these one can improve health through one's qi (Norman 1989). Reflexologists divide the body into ten equal vertical zones, five on the right and five on the left (wikii 2005). Concerns have been raised by medical professionals that treating potentially serious illnesses with reflexology, which has no proven efficacy, could delay the seeking of appropriate medical treatment (wikii 2011). Below is a chart of reflex areas on the foot that is widely available

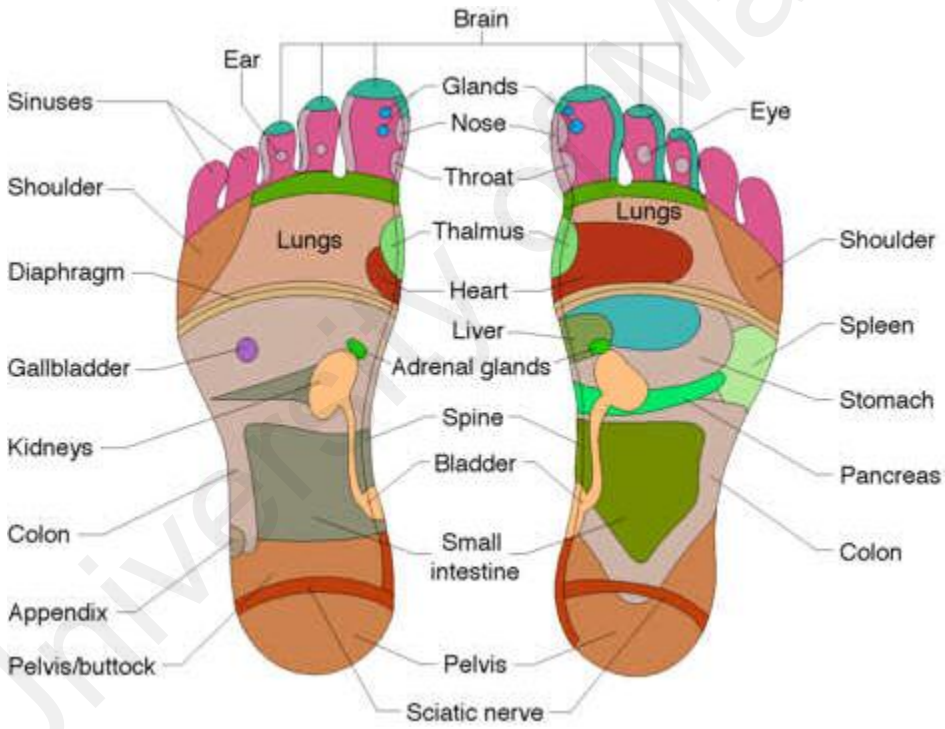

Figure.2.1 Shows the reflexology foot chart where reflex areas on the foot that is widely available.(Wikii 2008).

2.3.6 Hilot massage

Hilot massage is normally used for relaxing stressed muscles. It is an ancient Filipino art of healing. This massage uses chiropractic manipulation for the diagnosis and treatment of musculoligamentous and musculoskeletal ailments. This massage is usually cheaper alternatives to medical doctors in the Philippines. Hilot massage is very useful to reset dislocated and sprained joints like knee, ankle, and fingers (Grant 2008).

2.3.7 Medical Massage

This massage is an ambiguous term in the profession of massage. Some people describe it as a specific technique whereas, others people treat it as a common massage category. Medical massage includes decongestive therapy used for lymphedema which can also be utilized in conjunction with breast cancer treatment (Lim SH January 1998).

2.3.8 Myofascial Release Massage

The Myofascial release massage is a type of soft tissue therapy. It is used for somatic dysfunction treatment. It was described by Andrew Taylor Still. This massage relaxes contracted muscles, increases circulation and lymphatic drainage, and stimulates the stretch reflex of muscles and overlying fascia.

Myofascial release is normally a manual massage technique for stretching the fascia and releasing bonds between fascia, integument, and muscles (wikii 2009). By doing this pain is eliminated. Myofascial release usually involves applying shear compression or tension in various directions, or by skin rolling (DiGiovanna 2005).

2.3.9 Stone Massage

In stone massage water-heated stones are used to apply pressure and provide heat to the body. The oil coated stones are also used by the therapist for delivering various massaging strokes. The type of hot stones employed is Basalt stones (or lava rocks). These stones are very polished and smooth. When these stones are put with the recipient's back, stones help to retain heat. By doing this, heat deeply penetrates into the muscles and releases tension (wikii 2009).

2.3.10 Swedish Massage

The term "Swedish" massage is usually recognized in English, Québécois or Dutch speaking countries only. In other countries this massage is known as "classic massage". This massage was developed by the Dutch practitioner Johan Georg Mezger. Swedish massage adapted five styles of long, flowing strokes to massage. These five basic strokes are effleurage, petrissage, tapotement, friction and vibration. This massage is proved to be very much helpful in reducing pain, joint stiffness, and improving function in patients with osteoarthritis of the knee over a period of eight weeks.

"Swedish Massage" raises variety of procedures specifically considered to relax muscles by applying pressure to subject against deeper muscles and bones, and rubbing in the similar direction as the flow of blood recurring to the heart (wikii 2008).

2.3.11 Thai Massage

This massage is known as "traditional massage" in Thailand. This massage was started in India based on ayurveda and yoga. Thai massage technique combines massage with yoga-like positions during the course of the massage. The northern style of Thai massage emphasizes on stretching whereas the southern style emphasizes on acupressure. Thai massage is done to loose,

comfortable clothes and lies on a mat or firm mattress on the floor. It can be done also in solo or in a many people of group or so patients in the same large room. The receiver is placed into many styled of yoga positions during the course of the Thai massage (wikii 2008).

2.3.12 Chinese massage

China massage is of two types namely Tuina and Zhiya. Tuina chines massage emphasizes on pushing, stretching and kneading the muscle whereas the Zhiya chines massage emphasizes on pinching and pressing at acupressure points. Tui Na is Chinese Medicine's Physio-Therapy which is employed for medical purposes instead of relaxation. Tui Na tried to solve the patient's problems from musculoskeletal conditions to cancer diseases and also minor and major headaches. Some other application like friction and vibration are also adapted in this massage (wikii 2006).

2.4 Benefits of Massage

The use of massage has been widely applied as a treatment for a number of diseases for more than 3000 years (Ferrel-Torry A.T. & Glick O.J. () 1993). The benefits of patients receiving massage, they feel such relief. These are physical effects of the massage we most often see.

- Increased circulation of blood and lumps.
- Relief of pain and tension.
- Improved sleep.
- Relief of constipation.

- The healing of diabetic foot ulcers is difficult and often takes long time to heal. It has been found that by using compressed air massage the time for its healing is decreased.

- The cancer patients suffer many changes to their bodies and minds. The use of Massage, reflexology has been treated as complementary therapies with traditional medical treatments to cancer. A lot of research on this topic has shown that use of massage to cancer patients decreases their anxiety, pain intensity, nausea, vomiting and fatigue.

- The patients after a surgery often have pain. The use of Foot massage and hand massages to the patient after being operated has shown that there is reduction in pain scores, heart rate and respiratory rate.

- The main reason of Peripheral artery disease is hardening and narrowing of the arteries, which some time result in decreased blood flow. The usage of Acupressure by various studies has shown that its use increases blood flow.

- Recently a report has been published by American Heart Association. In the report it is estimated that in the U.S country one among three people is high blood pressure patient. A research study has been carried out for finding the benefits of reflexology on blood pressure, cholesterol and life satisfaction. The research studies revealed that reflexology resulted in reducing the systolic blood pressure; however, its effect to the diastolic number and blood cholesterol levels did not show any improvement. The research report also mentioned that life satisfaction was improved significantly by using reflexology.

2.5 Types of Oil Used in Foot Massage

The use of different types of oil for massage has different effect. So far, a wide variety of oils have been used such as fractionated coconut oil, grape seed oil, olive oil, almond oil, apricot kernel oil, jojoba oil sesame oil, cocoa butter, shea butter, leech Sometimes, some salts are also combined with oils in order to remove dry skin. In this study, and leech oil have been tested. So far no massage has been done in leech oil.

Below is a brief description of various essential oils used for massage.

2.5.1 Sweet Almond Oil

Sweet almond oil is one of the most popular massage oils among massage therapists. Extracted from almonds, sweet almond oil is pale yellow in color. It is slightly oily, which allows hands to glide easily over skin. Sweet almond oil is absorbed fairly quickly, but not so quickly that you need to keep reapplying it. Compared with other oils, sweet almond oil is reasonably priced. It usually does not irritate skin. People with nut allergies should not use almond oil (Darmstadt GL 2002).

2.5.2 Apricot Kernel Oil

Apricot kernel oil is similar in texture and color to almond oil, but costs slightly more. It is rich in vitamin E, a quality that gives it a longer shelf life than the typical oil. Like almond oil, apricot kernel oil is absorbed into the skin, so it won't leave people feeling greasy afterwards. This property also makes it a good oil to use for aromatherapy massage. Apricot kernel oil is a good alternative to sweet almond oil for people with nut allergies (Darmstadt GL 2002).

2.5.3 Jojoba Oil

Jojoba is actually a wax extracted from the seed of the jojoba plant. Jojoba is a good option for most people prone to back acne because it is thought to have antibacterial properties and contains long chain wax esters that closely resemble skin sebum. Jojoba has a very long shelf life, so it's a good choice if you don't use it regularly. It is very well-absorbed, which makes it favourite carrier oil for aromatherapy. Jojoba is usually not irritating to skin. One drawback: jojoba oil is so silky and quickly absorbed, you may need to reapply it often or mix it with other oils listed here. It is pricier than sweet almond oil (Darmstadt GL 2002).

2.5.4 Fractionated Coconut Oil

Although you may think of coconut oil as being thick, white solid oil, fractionated coconut oil is actually light, non-greasy, liquid oil. It is called fractionated coconut oil because it contains only a fraction of the whole oil. The long-chain triglycerides have been removed, leaving only the medium-chain triglycerides. Fractionated coconut oil is less pricey than many other oils (it's comparable to sweet almond oil) and like jojoba oil, has a very long shelf life. But perhaps the top feature of fractionated coconut oil is that it tends not to stain sheets, a problem with most massage oils (Darmstadt GL 2002).

2.5.5 Sunflower Oil

Sunflower oil is light, non-greasy oil that won't leave skin feeling oily. The oil, extracted from sunflower seeds, is rich in the essential fatty acid linoleic acid, as well as palmitic acid and stearic acid, all components of healthy skin. The amount of linoleic acid in skin declines with age and can be stripped by harsh soaps and cleansers. Sunflower oil can go rancid quickly, so it

should be purchased in small quantities and stored in a dark cool area. Squeezing one or two capsules of pure vitamin E oil into the bottle may help to extend the shelf life. People with allergies to the sunflower plant family should avoid sunflower oil (Darmstadt GL 2002).

2.5.6 Avocado oil

Avocado oil is pressed from the avocado fruit. Deep green in color, avocado oil is heavier oil and is usually mixed with lighter massage oils such as sweet almond oil. Avocado oil is roughly double the cost of sweet almond oil. People who are sensitive to latex may be sensitive to avocado oil (Darmstadt GL 2002).

2.5.7 Cocoa Butter

Cocoa butter is very rich and has a distinct chocolate aroma. It is solid at room temperature and has a heavy texture, so it needs to be blended with other oils or used only for very small areas (Darmstadt GL 2002).

2.5.8 Grapeseed Oil

In many respects, grapeseed oil makes great massage oil. It has little-to-no odor, and it has a smooth, silky texture without being greasy. However, most grapeseed oil is extracted from grape seeds using a solvent (rather than being pressed from the seeds), which some aroma therapists say make it inferior oil for aromatherapy massage (Darmstadt GL 2002).

2.5.9 Kukui Nut Oil

A light, thin, non-greasy oil native to a Hawaii, kukui nut oil is typically used on all skin types, including oily skin and sun-damaged skin (Darmstadt GL 2002).

2.5.10 Olive Oil

Olive oil is commonly used as cooking oil, but it is occasionally used for massage. It is heavy oil with a greasy or sticky texture and recognizable aroma that many associate with cooking, so it's usually not used on its own for massage. One study compared topical olive oil with sunflower oil and found that olive oil had no effect on epidermal barrier function, whereas topical sunflower oil resulted in significant improvement in the skin barrier (Darmstadt GL 2002).

2.5.11 Sesame Oil

Sesame oil is prized in Ayurveda, the traditional medicine of India. It is used in a daily Ayurvedic self-massage called abhyanga, as well as shirodhara. According to Ayurveda, sesame oil is especially useful for nourishing and detoxifying and for ailments associated with the vata type, such as anxiety, poor circulation, constipation, bloating, and excessive dryness. Sesame oil is thick oil that may leave skin feeling oily, so it can be blended with lighter massage oils. The unrefined oil has a strong aroma (Darmstadt GL 2002).

2.5.12 Shea Butter

Extracted from the seeds of a tree native to Africa, shea butter is a solid at room temperature. Like cocoa butter, shea butter is heavy and can leave an oily feeling on skin, so it is usually not used on its own for massage. It may be blended or used for very small areas. Shea contains natural latex, so people with latex allergies should do a patch test before using it (Darmstadt GL 2002).

2.5.13 Wheat Germ Oil

Wheat germ oil is too thick to use on its own as massage oil, but it can be blended with lighter oils. Wheat germ oil is rich in vitamin E (Darmstadt GL 2002).

2.5.14 Leech Oil

Leech oil is not common oil used in massage; however we have used it in our study. It has real leech extracts and other herbs and its purpose is to dilate the blood vessels to create a better blood flow. However there is no scientific proof of this oil yet (Darmstadt GL 2002). For centuries, the leeching method has been used in treatment of following health conditions: acute infection, acute inflammation, heart problem, and circulatory disorders. In recent time, medical leeches are used to microsurgery. It helps to promote blood flow and stop the tissue from clotting (wikii 2008).

2.6 Bio impedance Analysis

Bio impedance analysis deals about the passive electrical properties of tissue and the ability of the impedance electrical current to flow. Bio electricity is the tissue ability in generating electricity such as done by the heart Electro Cardio Graph (ECG). Bio impedance, electrical properties of tissues and bio electricity are all similar things. The tissue electrical properties have been referred since 1871. These properties were tested for a wider frequencies range over larger range of tissues. (Thomasset A 1962; Thomasset A 1963) has a lot of research for measurement of electrical impedance as an index of total body water (TBW), using two subcutaneously inserted needles. The four-surface electrode BIA technique was given by (Hoffer EC 1969; Nyboer J 1970; Kyle, Bosaeus et al. 2004).

The surface electrodes has a drawback that it requires high current (800 mA) and high voltage to be applied for reducing the instability of injected current related to cutaneous impedance (10 000 O/cm2) (Boulier A 1990). BIA technique was introduced in 1970s, that technique under-pinned the relationships between impedance and body water content. The single frequency BIA

analyzers were commercially available in the market during 1990s. After some time several multi-frequency analyzers were also arrived in the market. BIA is now used as a bedside method because it is portable and safe. Its procedure is simple and non-invasive. The results of BIA are reproducible and can be quickly obtained. In latest, segmental BIA are developed for overcoming the inconsistencies within resistance (R) and body mass of the trunk.

2.6.1 Principle of BIA

The BIA principle is based on the fact that resistance (R) of homogeneous conductive material is proportional to its length (L) and inversely proportional to its cross sectional area (A) as shown in Fig.2.2 (U.G. Kyle 2004). The body is analogous to cylinder whose conductivity is not constant; however, a relationship can form between the impedance quotient (Length2/R) and water volume. The cylinder carries electrolytes that pass the electrical current from body. Practically, height can be measured more easily than length of conducting material. Thus, the formula is derived between lean body mass (typically 73% water) and height2/ R. As the body has inherent field in homogeneity, the value height2/R shows an equivalent cylinder having real geometry by putting an appropriate coefficient. This coefficient depends on many factors including the anatomy of the segments. However, an error is observed when resistively of conductive material is changed. The error will also be there when the ratio between height to conductive length, and in the shape of the body and body segments is changed.

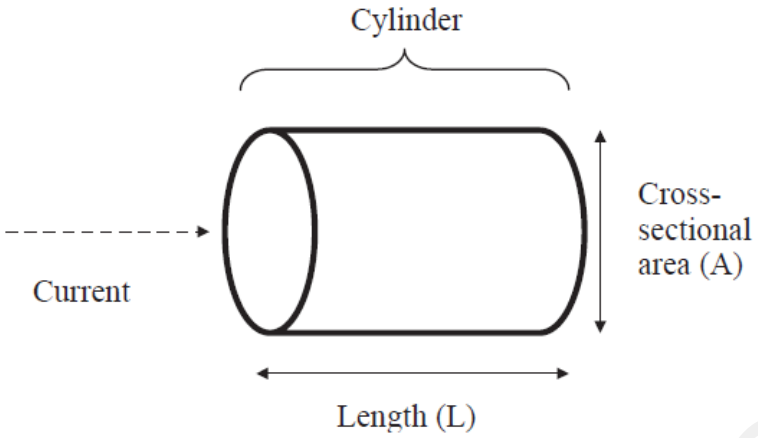

Figure.2.2 Show the Principles of BIA from physical characteristics to body composition

The Cylinder model is chosen to represent the relationship between geometry and impedance. Thus, resistance ðRÞ ¼ rL=A ¼ rL2=V; and volume ðVÞ ¼ rL2=R; where r is the resistivity of the conducting material and V equals AL. It should be noted that body has 2 different types of resistances offered to current: one is capacitative R (reactance), and other resistive R. The capacitance reactance produces due to cell membranes, whereas the resistive R produced from extra and intracellular fluid in vivo. Both resistance and reactance collectively are known as Impedance. The behaviour of biological tissues is described by different electrical circuits. One arrangement is the placement of resistance and capacitance in series, whereas another arrangement is in parallel as shown in Fig.2.3. (U.G. Kyle 2004) .The circuit which is universally used to show biological tissues in vivo contains the resistance of extra cellular fluid connected in parallel with second arm of the circuit. The second circuit arm comprises of capacitance and resistance of intracellular fluid in series. These variables can be measured over a wide frequency ranges by BIA analyzers which operate at (50-kHz). The insulator is formed by giving zero frequency because at zero frequency the current cannot pass through cell membrane. Due to this, current passes through the extra cellular fluid, which provides the measurement of R of the body

R0. However, at very high frequency the capacitor performs like a perfect capacitor. Hence, total body resistance R represents the total resistance of both intracellular and extra cellular fluid.

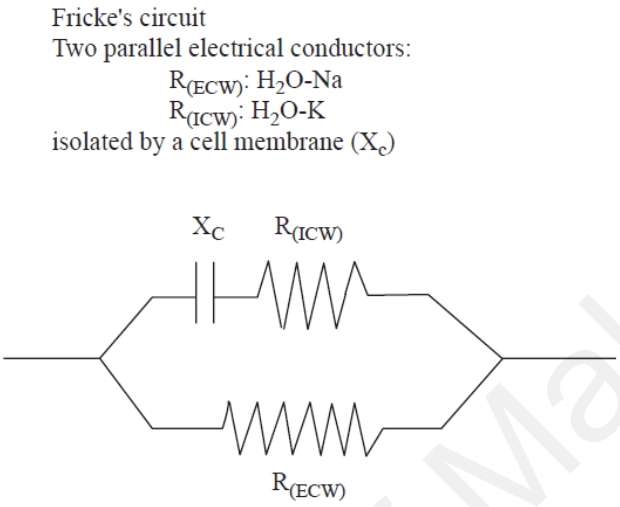

Figure.2.3 Show the diagram of Human body of resistance and capacitance connected in parallel or in series

The parallel model is shown by connecting 2 or more resistors and capacitors in parallel. In this model, during high frequencies the current passes through the intracellular space whereas for low frequencies current passes through the extra cellular space. Since, the application of direct current is prohibited due to practical constraints and the cause's occurrence of multiple dispersions. The value of resistance (R) for ideal measurement can be determined through Cole–Cole plot8 (negative reactance versus R plot). In this, R0 theoretically represents the resistance of the extra cellular fluid and RN shows the resistance of intra- and extra cellular fluid (TBW) and is shown in Figure.2.4 (U.G. Kyle 2004).

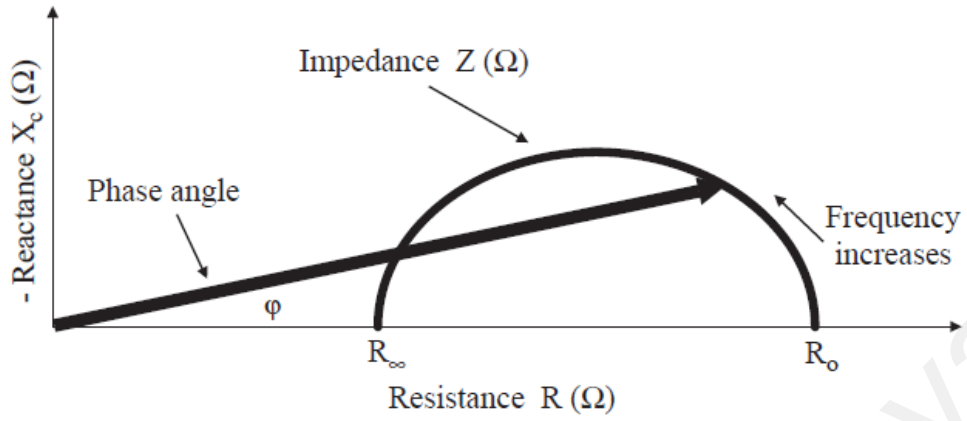

Figure.2.4 Shows Graphical Diagram of resistance for deriving relationship with resistance reactance, and impedance

It should be noted that application of 50 kHz frequency results in penetration of current through both intra and extra cellular fluid. However, the rate of penetration is different for each tissue. There is another type of connection of parallel model which tends to consider mixing effect. According to mixing theory, the value of resistance (R) of conductive fluids is directly proportional to amount of suspended non-conducting material. (Hanai T 1968) derived this formula through vitro models which is widely used in vivo. It should be noted that the formula further requires a number of assumptions (De Lorenzo A and . 1997; Ward LC 1998). The extensive research has been carried out to derive many conceptual parallel models for prediction of limbs composition e.g. limb muscle mass (Fuller NJ 1999). The main interesting point in this is the relationship between capacitance and R as this reflects different electrical properties of tissues. These properties can be affected in various ways through different diseases, nutritional and hydration status. In order to predict clinical outcome, the phase angle and other interrelated indices like R0/RN are used (Schwenk A 1998; Schwenk A 2000; Toso S 2000). After standardizing the height, R and capacitance are plotted graphically. This graph predicts several

diseases by forming distinct clusters (bioelectric impedance vector analysis (BIVA)). This is same behaviour as proposed by (Piccoli A 1994; Piccoli A 1997; Piccoli A 2002) and is shown in Figure.2.5 (U.G. Kyle 2004).

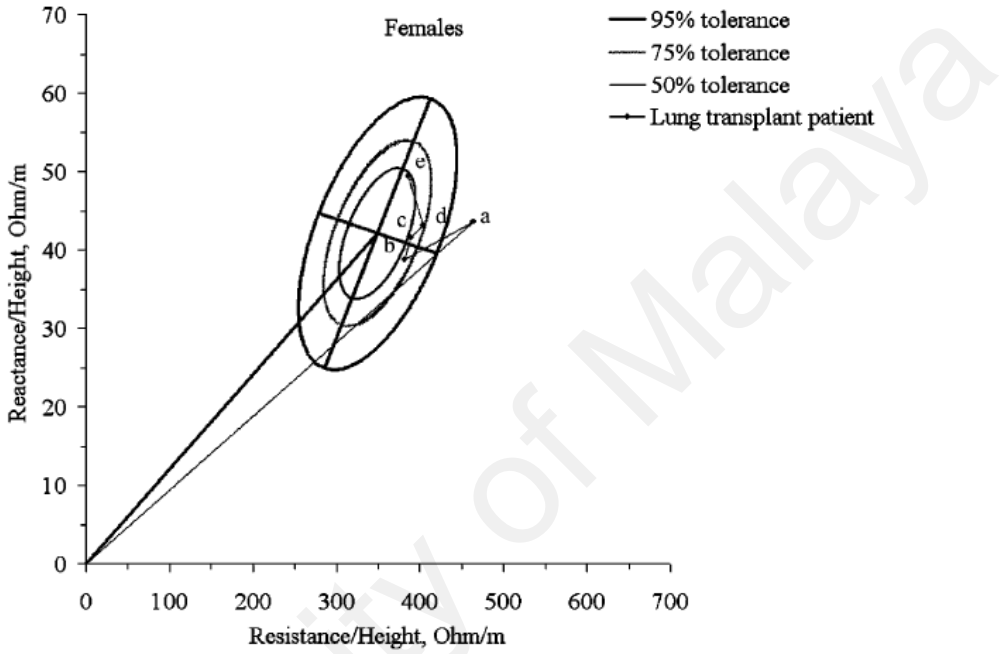

Figure.2.5 Shows the BIVA analysis graph of patient having lung transplantation

From the figure.2.5 it can be observed that bivariate tolerance intervals for the impedance vector are found to be 50%, 75%, and 95% tolerance ellipses measured through healthy Swiss reference population. This is tested on 2643 women having age between 18–59 years. After lung transplantation, impedance measurements were repeated with time period of (a) 1 month, (b) 6 months, (c) 12 months, (d) 18 months, (e) 24 months. From the figure.2.4 it can be observed that initial vector position shows the reduction of soft tissue mass. Furthermore, subsequent vector migration parallel to the minor axis of ellipses toward the target ellipse (b–d in woman) shows the improvement of nutritional status with increasing hydrated soft tissue mass. The last

migration of vector from the lower pole (BIVA pattern of tissue hyper hydration) to the centre of 50% tolerance ellipse goes through a path which is parallel to the major axis. This path shows the loss of excess fluid which result in complete restoration of tissue impedance. This stage was achieved by women after 24 months (e). Overall improvement in weight of women was increase from 54.2 to 68.8 kg (Piccoli A 2002).

2.6.2 Bio-electrical Impedance Analysis Methods

The most common method for the calculation of composition of body is bioelectrical impedance (BIA). In mid-1980's the term bioelectrical impedance was first use and this method became popular day by day due to the advantages like low cost, portable, noninvasive and requires minimal subject. For clinical and epidemiological issues the bioelectrical impedance analysis (BIA) is the best method. It is because of its reasonable costs, practicality, non-invasiveness and repeatability. This method is active for middle-aged adults and for young. Basically it is a simple instrument by which we can estimate our body fat. The main function of this device is to determine the electrical impedance of the body tissues through which TBW can be estimated easily. For estimating FFM we use this TBW by differences between body weight and body fat.

Bio-electrical Impedance Analysis is a painless low voltage method which applies AC current to body. At a single intermediate frequency most bio impedance devices work normally 50 kHz. Some component of intracellular fluid and extracellular fluid carry the applied current. The prediction equations have been produced based on bio impedance measurements which are taken at lower frequency of 5 kHz and higher frequencies of 100 kHz. Research has proved that BIA was quite variables and it is not a more accurate measurement method for calculating body composition. Now the new technologies improved BIA that is more reliable and more accurate for measuring body composition.

The equipment for BIA analysis is portable and safe so the use of BIA also increased, the procedure is noninvasive, simple and noninvasive, and the results are quickly obtained and reproducible (U.G. Kyle 2004). However, it is also true that it is not a "gold standard" or reference method. The result will depend on the test. This is a very simple instrument but we should carefully use this device. Also we should follow the method of use which is given by the manufacturer. For estimating body fat people normally use body fat meters. This body fat machine is a simple device to calculate our body composition; this machine is less accurate compared to other machines, which normally is used in clinic or for medical purposes.

Normally, BIA is measured in supine position by lying barefoot on the bed. In wrist and ankle electrodes are located. By measuring the resistance to the current, the percent body fat can be estimated. For having a good and accurate data the subjects need to eat and drink within 4 hours of the test and void (urinate) completely prior to testing. Recently more accurate method has been established for bioelectrical impedance analysis. This device is suitable for both healthy subjects and patients but sometimes there is some deficiency in quality control procedure. FFM and TBW can be determined from subjects without any electrical abnormalities and significant fluid.

Nowadays, obesity health problem is all over the world which states that illness decreases the expectancy of life by increasing the risk like osteoarthritis, coronary artery disease, certain types of cancer obstructive pulmonary disease and type II diabetes. In other sense a body having very small fat can also create health risk. This is due to the fact that for normal physiological functions we need a certain amount of fat. Bioelectrical impedance has become increasingly used for the assessment of body composition and body fluid status. Recently body composition is an interest topics now a days for the nutritionists because of the nutrition status, specific diet,

genetics exercise, disease these have major components of the human body. These components can be considered as whole body levels molecular, atomic, and cellular and tissue-system. For bioimpedence analysis two things are very important, one fat free mass (FFM) another one fat mass, because fat is an important factor for health issue. Following methods are considered for the analysis of bio-electrical impedance.

2.6.2.1 BIA Analysis with Single frequency (SF-BIA)

In this method, the BIA analysis is carried out by using single frequency of 50 kHz. This frequency is applied between the surface electrodes which are placed on hand and foot as shown in Figure.2.6 (U.G. Kyle 2004). However, some other locations are also used by BIA instruments like foot-to-foot (Utter AC 1999; Jebb SA 2000) or hand-to-hand electrodes. It should be noted that at this frequency the BIA analysis is strictly speaking not measuring TBW, however, a weighted sum of extra-cellular water and intra-cellular water resistivity.

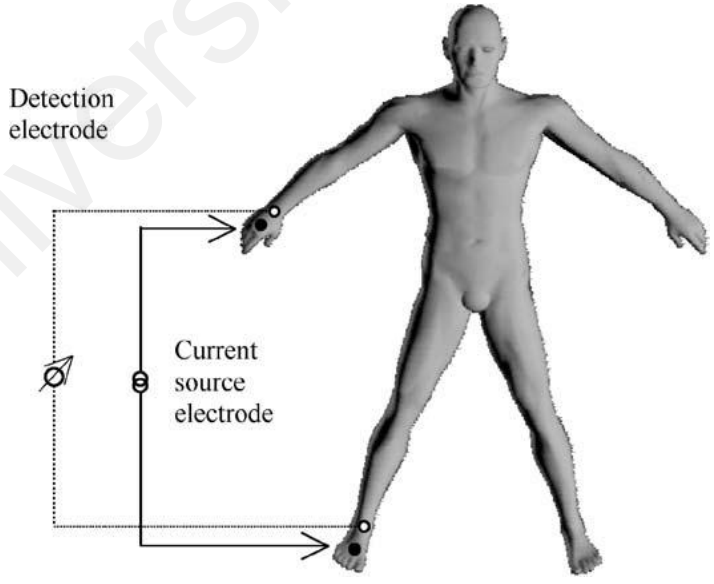

Figure.2.6 Shows standard placement of electrodes for BIA analysis

This analysis provides estimation of fat-free mass (FFM) and TBW. However, through this analysis the differences in ICW cannot be calculated. All these results of BIA analysis are based on a mixture theories and empirical equations. The empirical equation has been derived with healthy subjects having intact biological homeostasis. Although, this analysis don't provide valid results under major changes in hydration, it does not negate its application for the prediction of absolute FFM or TBW for normal hydrated subjects (Gudivaka R 1999).

2.6.2.2 BIA Analysis with Multi-frequency (MF-BIA)

In this method empirical linear regression models are used and impedances are included at multiple frequencies. This analysis employs variety of frequencies ranging from (0, 1, 5, 50, 100, 200 to 500 kHz) for the determination of FFM, TBW, ICW and ECW. The results of poor reproducibility have been observed when the analysis was carried out at frequencies below 5 kHz, and above 200 kHz 20. (Patel RV 1996) has concluded that for the prediction of ECW, BIA Analysis with Multi-frequency is more accurate but less biased than BIA Analysis with Single frequency. However, for TBW with critically ill subject, BIA Analysis with Single frequency is more accurate but less biased than BIA Analysis with Multi-frequency. According to (Hannan WJ 1998), when BIA Analysis with Multi-frequency was compared with bioelectrical spectroscopy, the BIA Analysis with Multi-frequency has better outcomes in prediction of TBW. However with equal prediction for ECW in surgical, it was not succeed to sense changes in the fluid movement between extra cellular and intracellular spaces within elderly patients.

2.7 Bioimpedance Parameters

Mainly there are five bioimpedence parameters are used.

They are:

1. Resistance

2. Reactance

3. Impedance

4. Capacitance

5. Phase angle

2.7.1 Impedance, Resistance, Reactance

Nowadays, the most popular method for measuring body composition is bioelectrical impedance analysis. In general in this method we need to use the resistance for calculate the current flow through the body for calculating total body fat in our body. Here the impedance (Z) is depended on frequency and oppose of a conductor for the flow of alternating current. Impedance (Z) can be defined as the ratio of voltage to current. There is a vector relationship between reactance (Xc) and resistance (R). These can be represent as $Z2 = R2 + Xc2$ (U.G. Kyle 2004).

Alternating current can be affected by resistance (R) by using bio impedance analyzer it can measure the resistance directly. Low resistance means large amount of fat free mass in human small amount of fat free mass means high resistance. Extracellular mass (ECM) and intracellular mass (ICM) can be express by resistance. The alternating current can be affected by reactance (XC) due to the capacitance presence characteristics within body because of intact cell membrane. Reactance can be also measured directly by the analyzer. From this reactance, body's

capacitance, body integrity and its cell mass size can be measured. Similarly smaller amount of the body cell mass means low reactance .And large amounts of body cell mass (BCM) means high reactance. BCM (body cell mass) have different active components like organ cells, blood cells, immune cells, including muscle cells (U.G. Kyle 2004).

2.7.2 Calculation of Capacitance of Body

The capacitance of body can be defined as the total amount of capacity to storage energy by cell mass compartment. Greater quantities having tight cell membranes have very high value of capacitance. The quality and number of cell membranes within the cell mass determine capacitance. Due to body composition the electrical current can be effects instead of measuring the stored charge directly. The ratio of charge Q to voltage V on the body is known as the capacitance, $C = Q / V$ (P. Deurenberg 1995).

2.7.3 Phase angle (PA)

The total body resistance and reactance and it is dependent of height is known as phase angle (PA).The equation of phase angle can be represented by Phase Angle (PA) = tan-1 (Xc/R). Lower phase angle means either breakdown of the cell membrane or cell death. Similarly higher cell membrane means large quantities of body cell mass and intact cell membranes (P. Deurenberg 1995). The nutrition health outcome and indication of health diseases can be represented by phase angle. Higher phase angle means optimal health which means good nutrition and consistent exercise. The average of phase angle is 6.7-7.7 and the optimal range is 7.8-9.4.

2.8 Body Composition

In general body composition can be described as percentage of bone, fat and muscle in human body. In our body muscular tissues have less space compared to other tissues like fat tissues. Sometimes two people having same height and weight but they look different each other from outside only due to their different body composition. The National Institute of health recommends that a healthy female should have 14-31% fat and male should have 6-24% fat. From athletes is has been shown for male fat percentage 7 to 19 % and for female 10-25%, depending on their sports.

For judging health condition the percentage of fat (body fat percentage) is very important in addition to body weight and is determined by analyzing the tissue and fluid compartments in human body. Our body is composed by fat, protein, water, and various vitamins and minerals. From body weight and body composition we can determine individual body shape. Different types of methods are used for measuring body composition.

Six major components are responsible for body composition they are lipid, water, protein, bone minerals, soft tissue minerals and carbohydrates. The total body water is mainly divided into two compartments like:

1) Extracellular

2) Intracellular

Fat free mass (FFM) includes with carbohydrates, soft tissue, fat, total body water, bone minerals and soft tissue minerals. But except bone all level of molecular compartment in fat free mass are present in lean soft tissue.(K Mohan Kishore 2010). Body fluids volume also consists of two things Extracellular fluid (ECF) and Intracellular fluid (ICF). The ECF has two components;

1) The body plasma

2) Interstitial fluid (ISF).

The ICF is a fluid contained within cells. Both of these account for the most water of the body. The total fat of body FFM can be measured by using body composition analysis and in other case it becomes the nutrition assessment process part. Thus, give useful information compared to BMI, because a change within weight of body may cause to change in either component. Blood pressure and cardiovascular diseases risk factors also depend on body fat that way body composition study is an important topic.

The nonfat parts also known as lean body mass (LBM) in which approximately protein 20%, water 73% and ash 1%. All the body's water and metabolic caloric expenditure are related with FFM. The meaning of LBM means body mass minus ether-extractable fat, and hence includes the stroma of adipose tissue. Fat free mass comprises of total water of body, metabolically active tissues and the source of metabolic caloric expenditure. LBM also means body mass minus ether-extractable fat, and hence includes the stroma of adipose tissue. Fat tissues are included in body weight. In our body fats are stored in different places. Example: liver, lungs, brain, heart etc. Some fats are needed for storing energy, internal organs which act as a insulate heat loss and a component of nerves and cell membranes.

Percentage of weight in determining the volume status is known as total body water (TBW) volume and is reported in liters. The distribution status of the TBW can be measured from ICW and ECW readings. Total fluid of body can be explained by TBW. Basically it is changed as a percentage of weight relates to the age; sex also many tissues of the subject. TBW is influenced by muscle mass. TBW is greater if the muscle mass more. Intracellular Water (ICW) is nothing

without potassium based fluid. In cell membrane it is found and it also relates with the phase angle. More ICW means higher Phase Angle. ICW is cellular level, which have a result of body composition. ICW is responsive. ICW is a specific indicator for catabolism. The muscles and organs of the cells (brain, liver, and kidney) have less fat and more water. Extracellular Water is basically sodium based volume of fluids. Normally is it available in the outside of the cell like interstitial, transcellular or plasma volume.

The amount of energy needed to the body is known as Basal Metabolic Rate (BMR) in order to perform the basic functions like heart breathing, breathing, digesting, muscle activity, blood circulation, and transportation of tissue and fluids. How many cells are producing oxidative energy is known as metabolic rate. More energy will require for more cell and also needed higher rate of basal metabolic. It has been reported that in metabolic and epidemiological researches, the estimation of body composition is an important factor. It is characterized by nutritional disorders mostly in the condition of underweight and in aged.

2.9 Equation for Body Composition Parameter

Reactance (X), resistance (R), phase angle, capacitance (C), and impedance (Z) can be measured directly by using bio impedance analyzer. At the same time patient's age, gender, height, weights are used for completing the results. Basal Metabolic Rate (BMR) calculation represents in whole 24 hours at a normal walking state total number of calories used in our body. Actually this calculation represents daily expenditure which is almost 90% of expenditure of caloric on daily basis. The BMR is also proportional with FFM. This relationship is like this if FFM increases then BMR will also increase; similarly if FFM decreases then BMR will also decreases. BMR (cals/day) = 31.2 * FFM (kg). Grande et al. introduced the BMR calculation in 1980.

(Cohen SH 2010) described the equation for Extracellular water (ECW) and Intracellular Water in 1986. These equations are based on relationship between cell mass of body and intracellular water and are shown as below:

$$ICW\ (liters) = a * Height2 * X/ R2 + b * Weight + c * Age + d \quad (1)$$

$$ECW\ (liters) = TBW - ICW \quad (2)$$

Here, the variables a; b; c and d represents the constant coefficients and each instance regression analysis are calculated by these.

By knowing the other parameters like Weight (kg); Height (cm); Age (years); Resistance (in ohm) and Sex (Male = 1 and Female = 0), some body composition parameters can be calculated. All these parameters are calculated using values at 50 Khz.

Table.2.1 Shows the body composition parameters and formulas.

Body composition parameters	**Formula**
Total Body Water (kg)	TBW = 0.372 (Height2÷ Resistance) + 3.05 (Sex) + 0.142 (Weight) – 0.069 (Age)
Fat Free Mass (kg)	FFM = TBW ÷ (Hydration constant) Whereby, Hydration constant = 0.73
Fat Mass (kg)	FM = Weight - FFM
Body Fat Percentage (%)	Body Fat Percentage (%) = (FM ÷ Weight) x100%

2.9.1 Body Composition Measurement

Body composition can be measured by various methods e.g. BIA analysis, Near-infrared Interactance (NIR), anthropometrics skin folds, Magnetic Imaging Resonance (MRI), Dual X-Ray Absorptiometry (DXA), Computed Tomography (CT) (Heyward et al, 1996).

2.10 Quad Scan 4000

The Quad Scan 4000 is a device normally used for body composition analysis. This device is a quick, easy, economical and non-invasive instrument which provides alternative methods for assessment of fluid composition analysis of Body. This includes radioisotope dilution, underwater weighing. Its basic working principle is based on measuring the current flow from body (impedance) when frequency is applied. The Figure.2.7 shows the diagram of Quad Scan 4000.

Figure.2.7. Shows schematic diagram ofQuad Scan4000 of fluid assessment and Body composition analysis

It has been observed that during low frequencies, the current fails to bridge the cellular membrane and thus, follow predominantly through the extra-cellular space. However, during

high frequencies the penetration of the cell membrane can happen due to which current is passed through both ECW and ICW. The ECW and TBW can be estimated by calculating impedance at frequency of 5 kHz and 200 kHz and by applying predictive equations and by subtracting ICW. It should be noted that the ECW is related to Extra-Cellular Mass whereas ICW has relation with Body Cell Mass.

The Quad Scan 4000 has a wide variety of application and can be used for the measurements and calculation of Extracellular water (%) and its volume, Intracellular water (%) and its volume, Total body water (%) and its volume, BCM, Extracellular water and Total body water Nutrition Index, Fat of Body (%) and its fat weight, Lean Mass of body, Dry Lean Mass, BMR, Average daily Requirement of calories, BMI, Body Fat Mass Index, Fat Free Mass Index, the measurement of impedance at 5, 50, 100 and 200 kHz frequencies, can be used for measurement of resistance, reactance and phase angle at 50 kHz frequency.

2.10.1 Quad Scan's Features

The Quad Scan 4000 has numerous features. Some of its features are summarized below:

- It is equipped with Multi-frequency BIA unit having Bluetooth facility for PC connection.
- Through using the Illness Marker concept of Quad Scan 4000 Segmental measurements can be obtained.
- This device is very safe and Non-invasive, easy to use and have very lightweight.
- It provides test results within seconds
- The Quad Scan 4000 is available with battery operated and has high contrast with two dimensional liquid crystal displays.

- The Quad Scan 4000 can be operated in number of languages such as English, French, German, Portuguese and Spanish.

2.10.2 The Advantages of Quad Scan's

The Quad Scan 4000 has many advantages and can be used for the measurement of the following things:

- It can be used for the measurement of non-invasive assessment of hydration and nutrition status.
- It can be used for the measurement of the status of nutrition of patients on admission and before-surgery.
- It can control and monitor the Illness Marker during the period when patient is hospitalized, without requiring weighing the patient.
- It provides Lean Body Mass, rather than Total Body Weight in order to determine the patient's improvement to nutritional supplements.
- It has the ability to monitor status of hydration.
- The facility of graphs in it helps for quick evaluation of remedial action.

2.11 Statistical Analysis

Statistical data is important to differentiate between inferential statistics and descriptive. Inferential statistics are applied in reaching conclusions from incomplete information and in other side descriptive statistics deals 25 with the enumeration, organization, and graphical representation of data. The data of statistics is very useful to differentiate between the two major of Statistics such as descriptive and inferential statistics. Descriptive statistics deals with the organization, enumeration, and graphical representation of data while inferential statistics are

applied in reaching conclusions from incomplete information. The objective of the statistical analysis is to compute the probability. For this analysis normally we use analysis of variance (ANOVA), a t-test or a non-parametric method.

2.11.1 Analysis of Variance (ANOVA)

For analysis of quantitative data the most common method is ANOVA (analysis of variance). The purpose of this test is to calculate the probability of which is the differences among them due to change. For comparing between two treatments t test is used. But ANOVA can be used for complex situation also for comparing several means. Normally it is used for two or more treatment means. In this method there are assumptions including the residuals which have a normal distribution here the variation is same in each group and the observations are independent in the same group. Sometimes, the post-hoc comparisons are required when the analysis does not show all means are significant different.

2.11.2The T-Test for Independent Samples

To determine the mean difference between two groups we normally use t test. For differentiate between two test groups of patients, normally we use t test.in this case, here one group is placebo another group is control group. Generally T test is reported by p level which represents the error probability which is involved in research hypothesis. It is related with the existence of a difference. In some research proposal one half of the probability distribution is considered and after that we need to divide it by p levels which now will reported with t test (U.G. Kyle 2004).

It's about the existence of a difference. Some researchers propose that by taking into account only one half of the probability distribution and dividing it with standard pleve.lin the predicted

direction. Here one is dependent variable another one is independent. The comparison between the means of the selected groups and specific values performed of the dependent variables.

2.11.3 The T-Test for dependent Samples

This test is useful in one type of design which in important source variation and can excluded easily from analysis. In this method two groups of scores are recognized to separate differences subjects if observation of both are measured with sample of subjects who were tested twice (e.g., before and after a treatment). When measurements are taken the same subject for the before and after some treatment such as massage therapy effect, the paired (dependent) t-test is normally used there (K Mohan Kishore et al, 2009). A null hypothesis can be defined as the average of the differences between a series of paired observations is zero. In order to test the null hypothesis this paired samples t-test is applied and measurement are paired. The term paired means that they are measured at the same samples.

For identify the differences between two conditions for an independent variables we use this method. In this method same participants are giving feedback in this experiment. The comparison between before and after having foot massage therapy is an example of it. The main hypothesis is that the pre measurement is different from the post, when the paired z (dependent) test. The last measurement taken from the subjects is known last measurement. The hypothesis can be represented by:

$$Ho: \mu 1 = \mu 2 \quad (1)$$

$$H1: \mu 1 = \mu 2 \quad (2)$$

Here, Ho= the null hypothesis of no difference between pre and post measurement. The significance level is 0.05.

CHAPTER 3 METHODLOGY

3.1 Introduction

This chapter contains the methodology used for this study. Bio impedance analysis is used to measure the bio impedance parameters before and after reflexology massage. Below shows that the step by step procedure for this thesis.

- Subjects were recruited at Kota Damansara and PJ Section 17.
- Consent form was filled up by the subjects.
- Conduct the subject's protocol for each exercise.
- The data base system was constructed.
- The readings were taken from the subjects fill a personal particulars form before reflexology treatment.
- Data was measured before reflexology.
- Subjects were undergone the reflexology.
- Data was measured after the reflexology.
- Analyze data and measurement result using statistical analysis.

3.2 Subjects/Participants

Total numbers of subject is fifty 40 males and 10 females subjects are recruited for this study. The location of the study was Reflexology Spa in Giant Mall of Kota Damansara and International House of University of Malaya. They need to provide their:

- Age
- Height
- Weight
- Physical activity
- Purpose of having reflexology
- Sex
- Passport or I.C

The baseline measures of standing height and weight were taken before the measurement session. The height should be measured without shoes it may be similar near 0.5m similarly body weight should be measured without shoes and with light cloths .Weight also near duplicate 0.5kg. Standing height and weight were used to calculate the BMI (kg/m2).

Out of these 50 subjects, 25 used leech oil in the right foot and aroma oil the left foot. For the remaining 25, the oils were interchanged. The average age of the subjects was 20-30. The Races of the subjects were South East Asia, South Asian, Arab, Iranian, African and Caucasian; however the maximum number were South East Asian and South Asian. Each reflexology session was done for 30 minutes with 15 minutes in one foot and 15 in the other.

3.3 Conducting BIA Measurement

In our body we have lean tissues, in which electrolyte containing water is available, this will conduct with the electrical current, and the fat inside our body acts as an insulator, and this is the basic principle of the method. By low impedance lean tissues, the impedance of the body can be measured. The relation between impedance and Fat Free Mass is determined through regression equations. When a frequency of 50 KHz was applied, the applied current was not succeeding to pass through the cell membranes and follows only extra-cellular space.

3.3.1 Subject Test Position

The self-adhesive disposable electrodes are attached to the leg (one set on the knee and the other on the foot). The Body stat Quad Scan 4000 unit has two main lead wires. It does not matter which of the two sets of main leads are connected to the knee or foot. They are therefore interchangeable. However, it's also important to remember that, just behind the knee and toe need to connect the red (injecting) leads, shown in Figure 3.1. For convenience, the metal tab on the electrode should point in the direction from which the lead wire tension will occur as illustrated in the figure and similarly as left foot.

Figure.3.1 Shows that the right leg electrode connection

The RED leads are the source of power and sends the signal through the body - the injecting leads. The BLACK leads are the sensing or measuring leads. If the leads are not connected to the body correctly, the current cannot be transmitted effectively and therefore the impedance measurement will be inaccurate or the following message will be registered on the LCD screen.

Figure.3.2 Shows Quad Scan 4000 The device used in this study

Figure.3.3 Shows long Electrode used with Quad Scan 4000

3.3.2 Data Measurement

Quad Scan 4000 Bio impedance Analyzer is used to measure body composition parameter of the subjects. Before the reading is measured, some subject's information was put into the device by typing it using the key provided. The total procedures are given below:

1. At first patient must lie down in the correct position (supine).
2. Should be careful about that the patient's body parts should not touch each other.
3. Now we need to place electrodes in patient's leg.
4. Then we need to attach the crocodile clips to the electrodes (clips to the metal tab strip of the electrodes back to ankle and lower knee).

5. Switch the Quad Scan 4000 unit ON.
6. Next step is to key in proper subject data.ie weight, height etc.
7. The patient should be in supine position for 3-4 minutes for entire procedure.
8. Press Enter key or measurement.
9. Results can be displayed within 10-11 seconds on the LCD display.
10. Now the electrodes need to be disconnecting the crocodile clips.
11. Electrodes need to be removed.
12. Then the patient can sit or stand up.
13. Switch off the device the Quad Scan 4000.
14. The results actually stored in the memory of Quad scan, the result can be downloaded from the device by using Bluetooth and body stat software (in the device the most recent 100 tests are stored).
15. Before doing the first time, our laptop needs to be pair with the device.
16. After downloading all data's we can convert all data in MS Excel format by using Microsoft Excel software.
17. Finally the SPSS 19 software needs to install in laptop for ANOVA and Pair T test analysis.
18. Procedure is repeated for both before and after reflexology.

3.4 Statistical Analysis

Data were analyzed using the statistical analysis. The SPSS version 19.0 for Windows (SPSS Inc., Chicago U.S.A) and Microsoft Office Excel version 2010 were used to analyze data measurement. Microsoft Office Excel 2010 is a common application for Windows, ease of use and gives variety graph construction and display. This program was used to key the database.

"SPSS 19.0 for Windows" is very good interactive power, also very easy to use and it is basically a windows based statistical tool which is perfect for statistical analysis. SPSS is one of the computer statistical programs that be used to analyze when conducting research, survey, analyzed large volume of social data and the other field of research and statistical purposes.

3.4.1 Analysis of Demographic Variables

Before doing the test and measurement, each patient needs to fill up the patient information form. In that form patients need to mention about their age, occupation, place of living, weight, height, number of treatment have done (foot massage), and purpose of having foot massage treatment. All these information they need to provide for demographic analysis. Now all the data need to convert in SPSS 19. After converting all data in SPSS 19,

The steps are as follows:

analyze→DescriptiveStatistic→Frequencies→select the variables from the left box→clickok→the result will be shown.

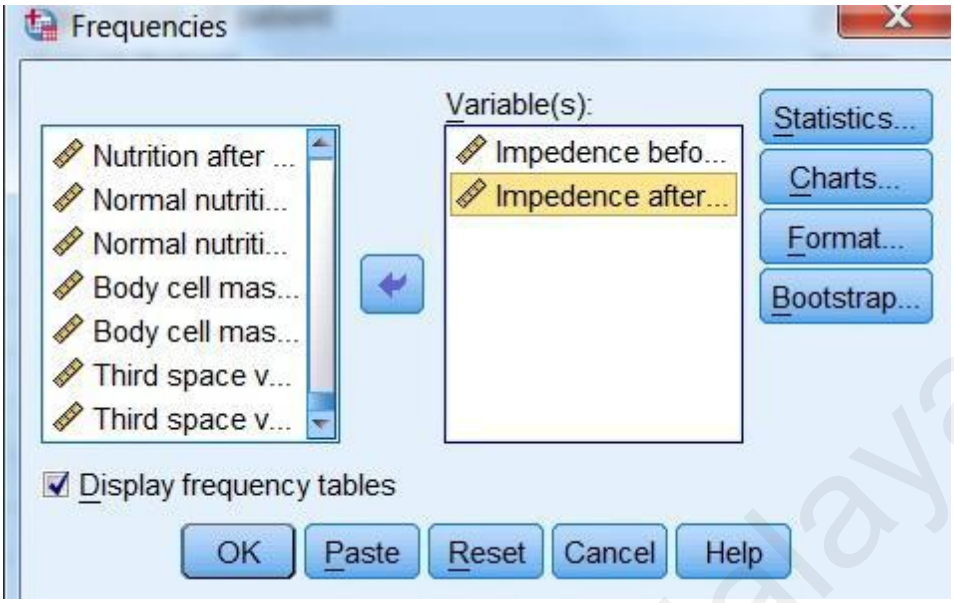

Figure.3.4 Window pop up Frequencies

3.4.2 Analysis of Bio-Impedance Parameters

The main objective of this research is to investigate the foot massage effect in human body in terms of resistance (R); reactance (X); impedance (Z); Phase angle; and Illness marker of male and female subjects that can be measured as bio impedance (BI) parameters. The body composition parameters are automatically calculated based on formulae stored in the device using the measured bio impedance (BI) parameters. This is shown in Table 3.1 below. Please list all the parameters in the table.3.1.

Table.3.1 Shows the Bioimpedance Parameters and its different frequencies.

Bio impedance Parameters	Frequency
Impedance	5KHZ
Impedance	50KHZ
Impedance	100KHZ
Impedance	200KHZ
Resistance	50KHZ
Reactance	50KHZ
Phase Angle	50KHZ
Illness marker	-

3.5 Comparison Analysis

In this analysis, the comparison between bio impedance parameters before foot massage treatment and after foot massage treatment is done. It is reported into main parameters and secondary parameters of bio impedance. The pair t-test is used for the overall comparison without considering the interaction with independent variables. Procedure running the test is shown below.

3.5.1 Running the paired sampled t test:

- Choose Analyze→Compare Means→ Paired sampled T Test… to open the paired sampled T Test dialog box.

- Transfer the paired variables in the left hand box from the right box →click ok.

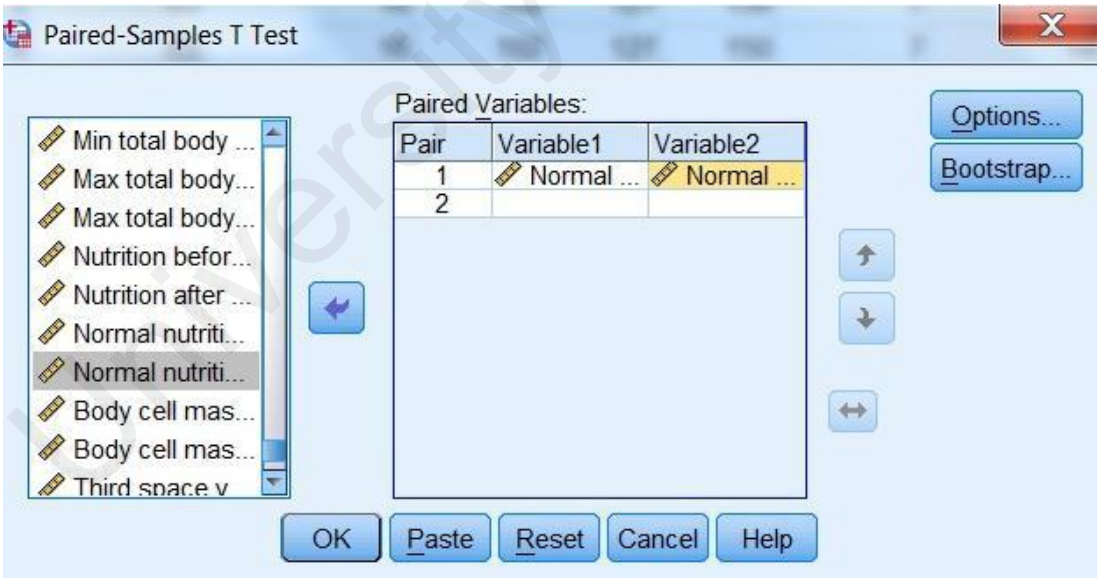

Figure.3.5 Windows pop up for Paired –Sampled T Test analysis.

The analysis for the effect of gender on the bio impedance parameters before and after foot massage treatment is done by using independent t-test. For the other independent variables, ANOVA is used. Procedures running both tests are shown below.

3.5.2 Running the independent sampled t test:

- Choose Analyze→Compare Means→ click the test variables from left side→click grouping variables from left side→define the group→click continue →back to the previous box →click ok for output.

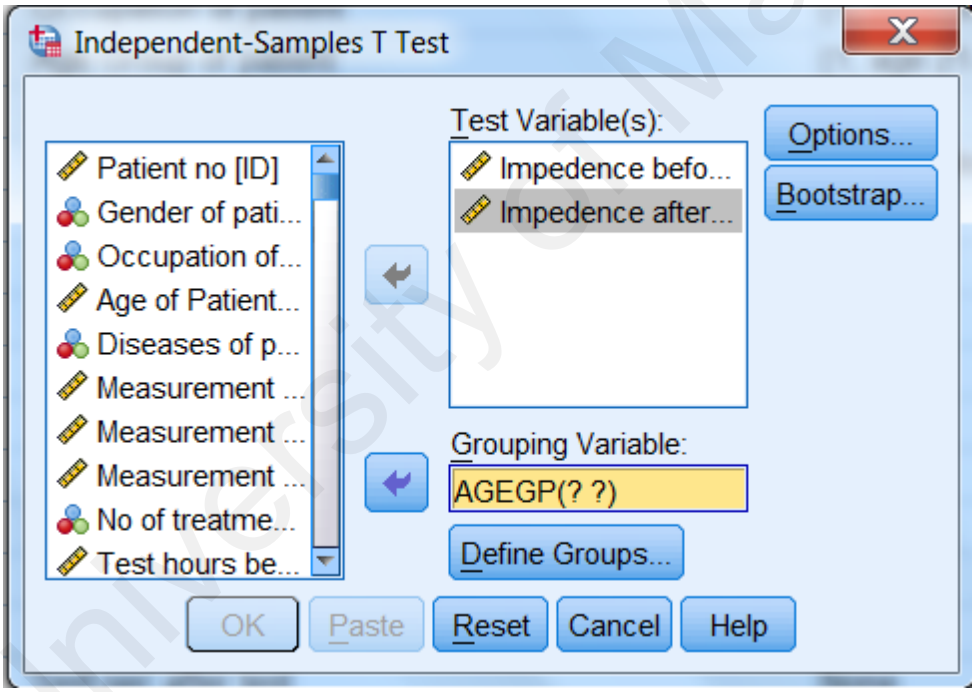

Figure.3.6 Windows pop up for Independent sampled t Test.

3.5.3 Running the one-way ANOVA:

- Choose Analyze→Compare Means→ One-Way ANOVA will appear→ select the dependent variables from left side box→ click factor →click ok (if the factor not more than two).

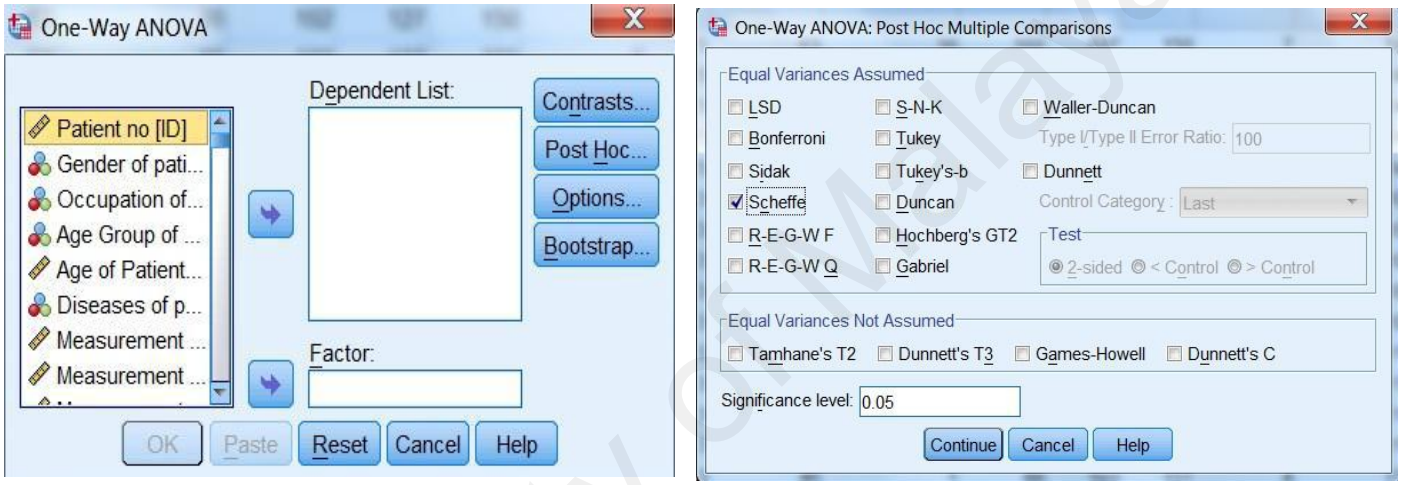

Figure.3.7 Windows pop up for One-Way ANOVA and POST hoc multiple comparisons

If the factor more than two:

- Click Post Hoc→ One-Way ANOVA: Post Hoc Multiple Comparisons dialog box →click scheffe→put

If the factor more than two:

- Click Post Hoc→ One-Way ANOVA: Post Hoc Multiple Comparisons dialog box →click scheffe→put significance value .05→ then click OK turn the one-way ANOVA test.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

In this chapter SPSS program has been used because of it friendly user by generating decision-making from graphical output using variety of report and analytical asset storage. Therefore, during this experiment, statistical analysis was carried out using the SPSS software program (SPSS version 19). The raw data for all measurements were prepared in Microsoft Office Excel 2010 which is easy to use and therefore can generate variety of graph easily.

The results from the data measurement are included in this chapter. All the information and results were obtained from questionnaire and data measurement. The data measurement was obtained from Quad scan 4000 Impedance Analyzer. Database for raw data measurements were then prepared in Microsoft Excel, which were later imported to SPSS. The analysis of the database was conducted by using SPSS software. The descriptive and demographic data were performed to all the subjects and the measured bioimpedance parameters consists many parameter. The main bioimpedance parameters are Resistance (R), Reactance (X), Impedance (Z), and Phase Angle and Illness marker.

4.2 Demographic Data

There were total 50 subjects having 40 males and 10 females. This group of subject is also divided in different groups according to subject daily activity, age group and BMI. They are served as independent variables in this study. The summary of these demographic variables are illustrated in Table 4.1.

Table.4. 1 Shows summary of Demographic statistical data for all subjects.

Parameter		Frequency (number of subjects)	Percent (%)
Gender	Male	40	80.0
	Female	10	20.0
Age Group in years	21-30	41	82.0
	31-40	4	8.0
	41-50	5	10.0
BMI Group	under weight	3	6.0
	normal weight	28	56.0
	over weight	18	36.0
	obese	1	2.0
Exercise Activity	Very Low	20	40.0
	Low/Medium	20	40.0
	Medium	10	20.0

Figure 4.1 shows the gender distribution of the subject involved in this study. Twenty percent are female and 80 percent are males.

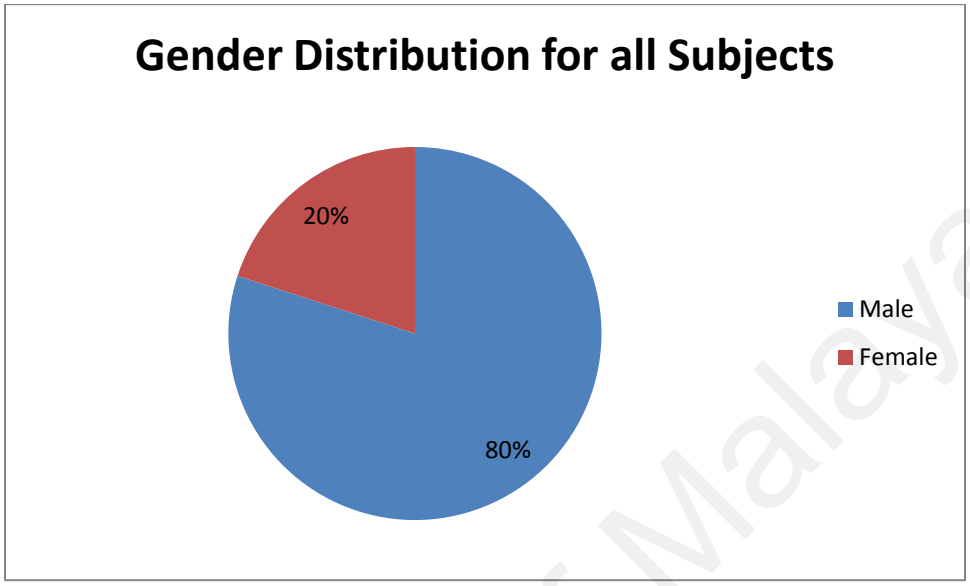

Figure.4.1 Shows gender distributions for all subjects

Figure 4.2 shows age group distribution of the subject. Age of the subjects is grouped into three categories. Group 1 is ranging from 21 to 30 years of age which makes eighty-two percent of the subjects in this category. Group 2 is ranging from 31 to 40 years of age and it comprises eight percent of the subjects. Finally, last 10 percent of the subjects are in group 3. This group is for the subjects age ranging from 41 to 50 years.

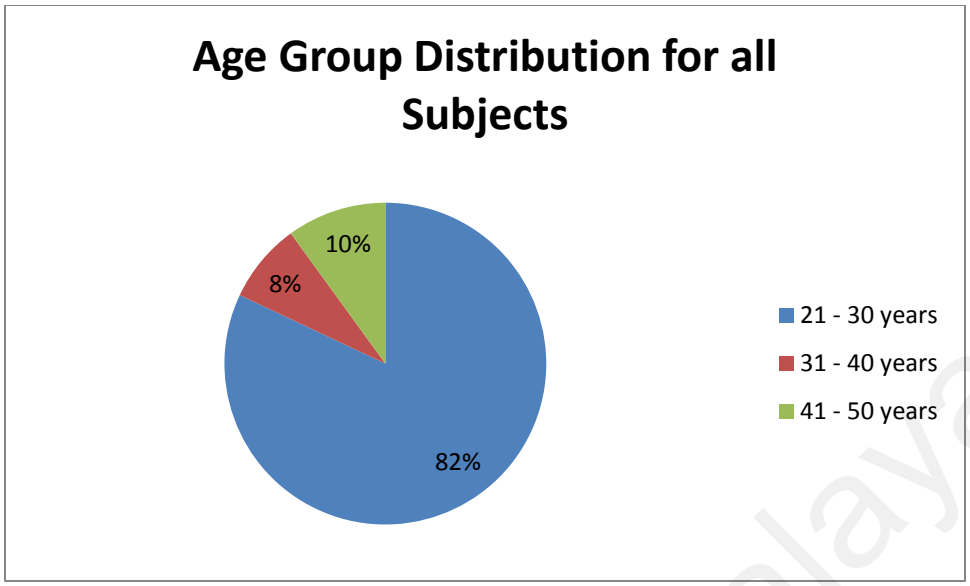

Figure.4.2 Shows age group distributions for all subjects

Figure 4.3 shows the BMI groups of the subjects. BMI of the subjects are grouped into four categories. Group 1 is for underweight subjects BMI are ranging <18.8. Six percent of the subjects are in this category. Group 2 is for normal weight subjects BMI which are ranging from 18.5-24.9. Fifty Six percent of the subjects are in this category. Group 3 is for overweight subjects of BMI which are ranging from 25-29.9 and finally group 4 is for Obsesses BMI which are ranging >30. Two percent of the subjects are in this category.

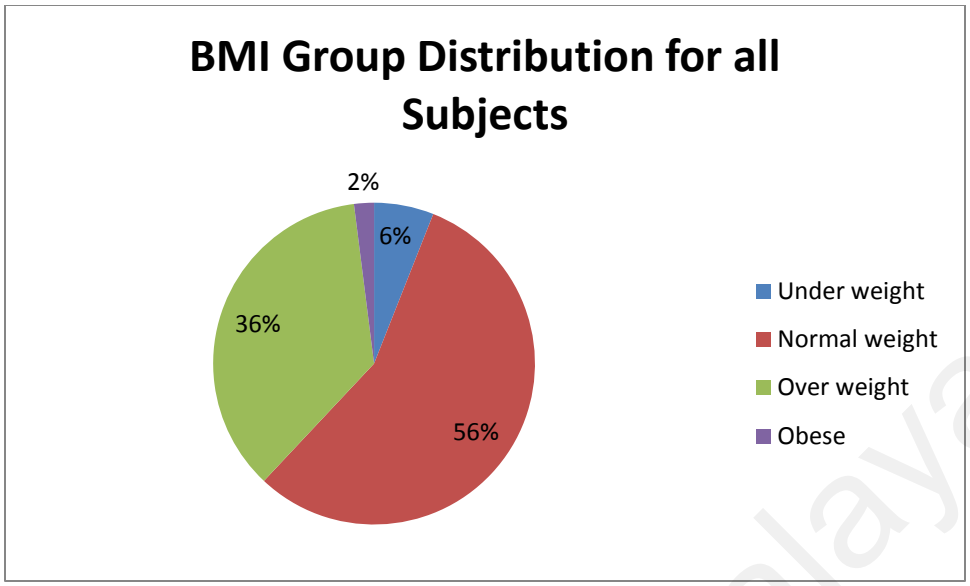

Figure.4.3 Shows BMI group distributions for all subjects

Figure 4.4 shows exercise activity group of subjects. Activity of the subjects is grouped into three categories. Group 1 is for very low of activity group which is ranging from the subject who cannot do any exercise on daily bases which makes forty percent of the subjects are in this category. Group 2 is for low/Medium of activity group which include subjects who rarely exercise on daily bases which includes forty percent of the subjects in this category as well. Group 3 is for Medium of activity group which includes subject who do exercise on daily bases leaving the percentage of only twenty of the subjects are in this category.

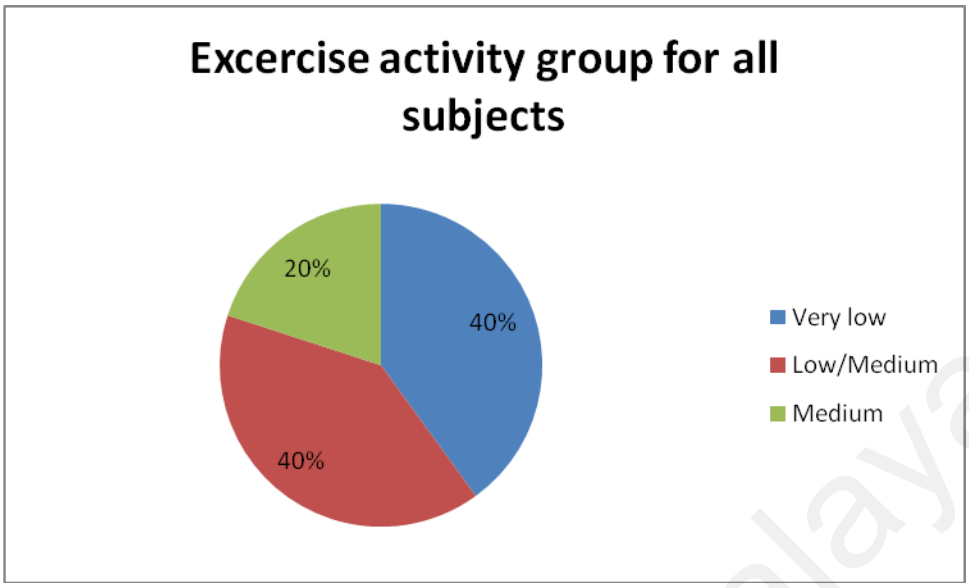

Figure.4.4 Shows exercise activity group for all subjects

4.2.1 Demographic Data for Male subjects

There were 40 male subjects from 50 subjects which can be divided in to different groups of independent variables (Activity, Age and BMI). These variables were used in the statistical analysis for male subjects. Summary of demographic data for each variable are shown in Table 4.2.

Table.4. 2 Shows summary Demographic data for male subjects

Parameter		Frequency (number of subjects)	Percent (%)
Age Group in years	21-30	35	87.5
	31-40	2	5.0
	41-50	3	7.5
BMI Group	under weight	3	7.5
	normal weight	19	47.5
	over weight	17	42.5
	Obese	1	2.5
Exercise Activity	Very Low	11	27.5
	Low/Medium	19	47.5
	Medium	10	25.0

Figure 4.5 shows age group distribution of the male subjects. Age of the male subjects is grouped into three categories. Group 1 is ranging from 21 to 30 years of age, eighty-seven and half percent of the male subjects are in this category. Group 2 is ranging from 31 to 40 years of age and it comprises five percent of the male subjects. Finally, last seven and half percent of the male subjects are in group 3. This group is for the male subjects age ranging from 41 to 50 years.

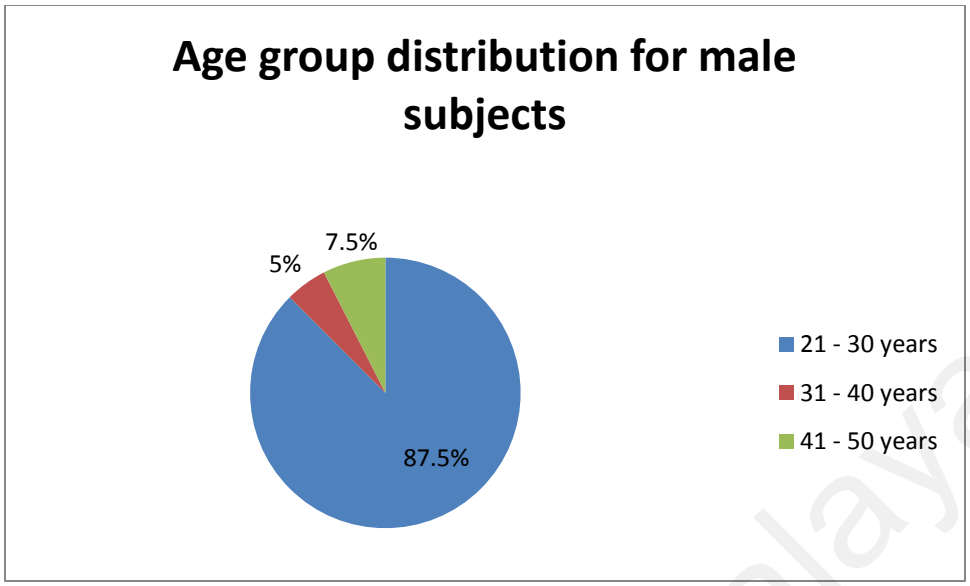

Figure.4.5 Shows age group distributions for male subjects

Figure 4.6 Shows the Pie chart BMI group of male subjects. BMI of the male subjects are grouped into four categories. Group 1 is for underweight of BMI is ranging <18.8. Seven and half percent of the male subjects are in this category. Group 2 is for normal weight of BMI is ranging from 18.5-24.9. Forty six and half percent of the male subjects are this category. Group 3 is for over weight of BMI which are ranging from 25-29.9. Forty two and half percent of the male subjects are this this category. Group 4 is for Obese of BMI which is ranging >30 and two percent of the male subject are in this category.

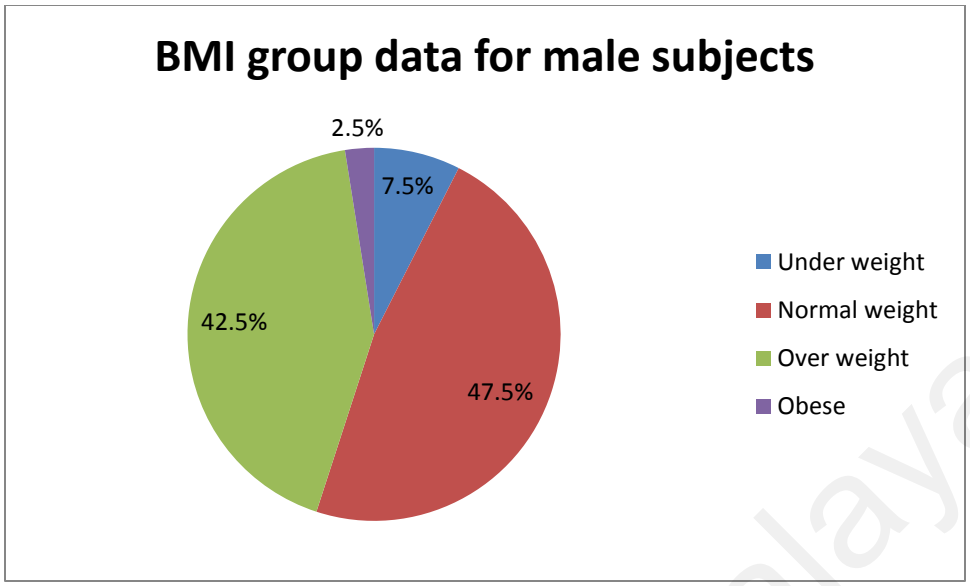

Figure.4.6 Shows BMI group distributions for male subjects

Figure 4.7 shows exercise activity group of male subjects. Activity of the male subjects is grouped into three categories. Group 1 is for subjects who do very low activity group and don't do any exercise on daily bases. Twenty seven and half percent of the male subjects are in this category. Group 2 is for low/Medium of activity group which include male subjects who do exercise rarely on daily bases. Forty seven and half percent of the male subjects are in this category. Group 3 is for Medium activity group that has male subjects who do exercise daily making it twenty five percent of the male subjects in this category.

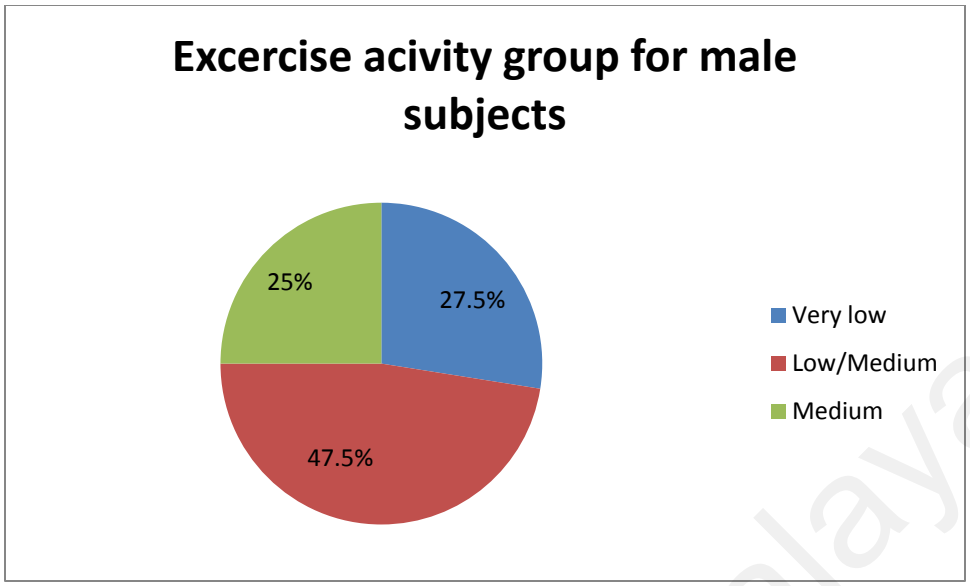

Figure.4.7 Shows exercise activity group for male subjects

4.2.2 Demographic Data for female Subject

There were 10 female subjects from 50 subjects. It can be divided in to different groups of independent variables (Activity, Age and BMI). These variables were used in the statistical analysis for female subjects. Summary of demographic data for each variable are shown in Table 4.3.

Table.4. 3 Shows summary of Demographic data for female subjects

Parameter		Frequency (number of subjects)	Percent (%)
Age Group in years	21-30	6	60.0
	31-40	2	20.0
	41-50	2	20.0
BMI Group	normal weight	9	90.0
	over weight	1	10.0
Exercise Activity	Very Low	9	90.0
	Low/Medium	1	10.0

Figure 4.8 shows age group distribution of the female subjects. Age of the female subjects is grouped into three categories. Group 1 is ranging from 21 to 30 years of age. Sixty percent of the female subjects are in this category. Group 2 is ranging from 31 to 40 years of age and it comprises twenty percent of the female subjects. Finally, last twenty percent of the subjects are in group 3. This group is for the female subjects age ranging from 41 to 50 years.

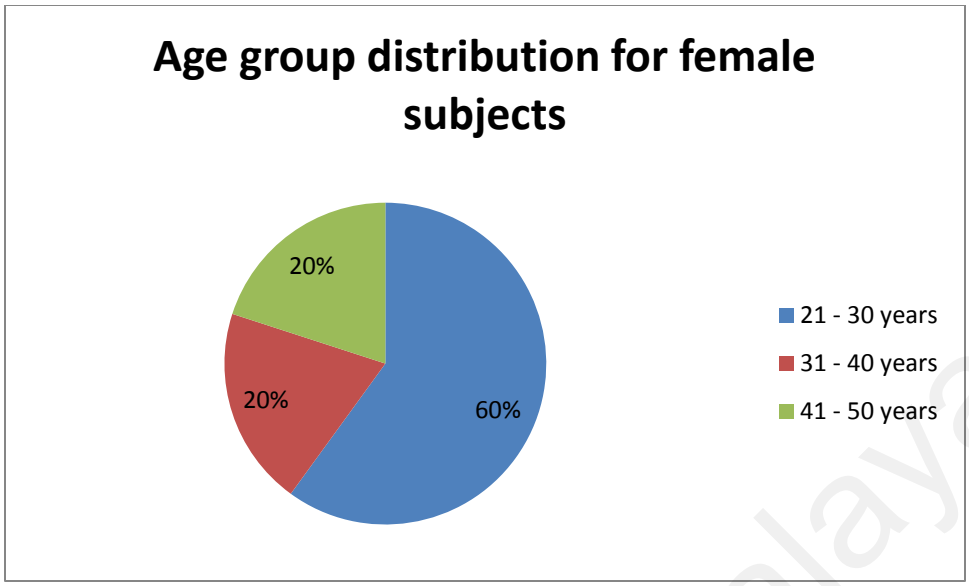

Figure.4. 8 Shows age group distributions for female subjects

Figure 4.9 shows the BMI groups of the female subjects. BMI of the female subjects are grouped into four categories. Group 1 is for underweight of BMI is ranging <18.8. None of the female subject fall's in this category. Group 2 is for normal weight of BMI is ranging from 18.5-24.9. Ninety percent of the female subjects are this category. Group 3 is for over weight of BMI is ranging from 25-29.9.Ten percent of the female subjects are this category. Group 4 is for Obese of BMI ranging >30. None of the female subject fall's in this category.

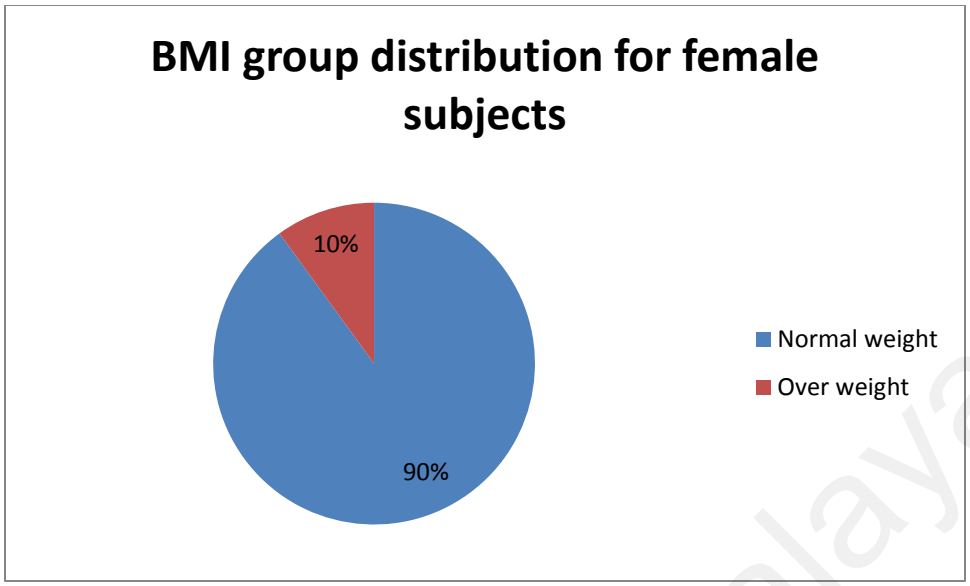

Figure.4. 9 Shows BMI group distributions for female subjects

Figure 4.10 shows exercise activity group of female subjects. Activity of the female subjects is grouped into three categories. Group 1 is for very low of activity which include female subject who does not do any exercise daily. Ninety percent of the female subjects are in this category. Group 2 is for low/Medium of activity for female subjects who do exercise rarely. Ten percent of the female subjects are in this category. Group 3 is for Medium of activity for female subjects who do exercise on daily bases. None of female subject fall's in this category.

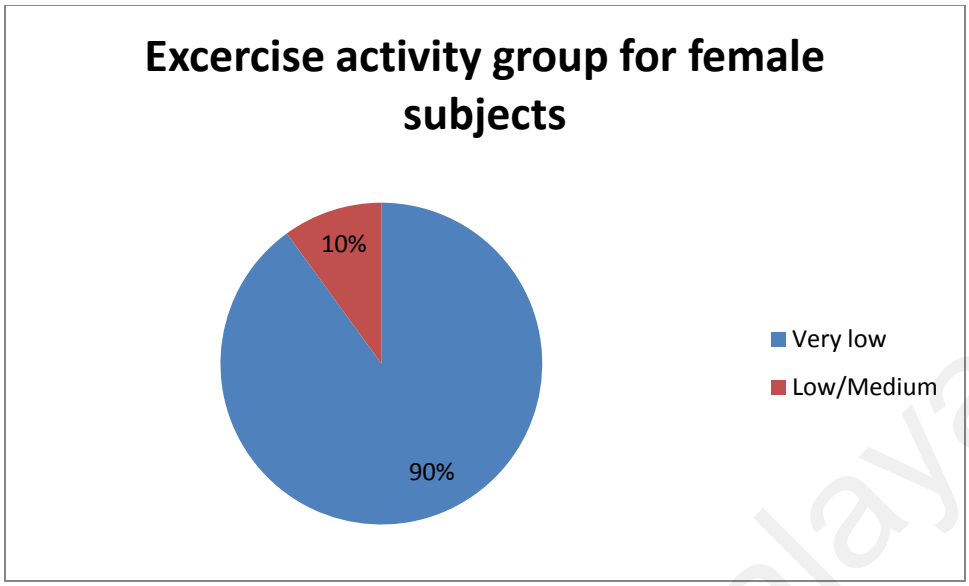

Figure.4. 10 Shows exercise activity group for female subjects

4.3 Statistical Comparison of Bio impedance Parameters

In this section the statistical comparison of Bioimpedance parameters are between before and after treatment, in after treatment have been use two oil (Aroma and Leech).In treatment first 25 subjects have been used Aroma oil in left leg and Leech oil in right Leg; rest of 25 have been used Leech oil in left leg and Aroma oil in right leg.

Table below shows that the comparison of Bio Impedance Parameter between Leg 1 and Leg 2 before (no oil) and after treatment (aroma and leech oil). There are two values, one of them is equal variance assumed and second is equally variance not assumed. Independent t test is used to analysis the data. For conducting the experiments no oil was applied before and starting with the treatment two of the oils aroma and leech were applied on the both legs.

Table.4. 4 Independent t-test results for the comparison of no oil, Aroma oil and leech oil of both legs

Bio Impedance Parameter	No Oil(p)	Aroma Oil (p)	Leech Oil (p)
Impedance 5k	.001	.001	.047
Impedance 50k	.092	.002	.000
Impedance 100k	.922	.075	.030
Impedance 200k	.935	.000	.000
Resistance 50k	.798	.020	.005
Reactance 50k	.797	.152	.274
Phase Angle 50k	.838	.051	.004
Illness marker	.982	.246	.306

Note: the p in parentheses is Equal variance not assumed

The result of table 4.4 shows there is no significant difference ($p>0.05$) in no oil in all parameters expect Impedance at 5k.

There is significant difference of Aroma oil in bio impedance parameters except Impedance at 100k, Reactance at 50k phase angle and Illness marker. In Leech oil has significant difference except Reactance at 50k and Illness marker, but the comparison between no oil, Aroma and leech, the difference of leech oil is more significant.

Table 4.5 below shows that the comparison of Bio Impedance Parameter between Leg 1 and Leg 2. Paired T test is used to analysis data. For conducting the experiments no oil was applied

before and starting with the treatment two of the oils aroma and leech were applied on the both legs. It is also comparison of gender by used oil before and after treatment. Paired T test shows the comparison of before and after treatment.

Table.4. 5 Paired t-test result for the comparison of before and after Bioimpedance parameters of both legs between gender and different oils

Bio Impedance Parameters	Leg 1				Leg 2			
	Male		Female		Male		Female	
	Aroma	Leech	Aroma	Leech	Aroma	Leech	Aroma	Leech
Impedance 5k	.000	.156	.556	.003	.448	.000	.000	.043
Impedance 50k	.000	.000	.085	.302	.060	.000	.000	.488
Impedance 100k	.000	.006	.228	.479	.120	.000	.000	.226
Impedance 200k	.000	.015	.724	.616	.113	.000	.000	.197
Resistance 50k	.000	.001	.011	.368	.071	.000	.000	.692
Reactance 50k	.000	.000	.197	.000	.000	.000	.000	.000
Phase Angle 50k	.019	.000	.006	.021	.000	.303	.284	.342
Illness marker	.223	.308	.000	.001	.285	.790	.003	.000

The result of table 4.5 shows there is significant difference in Aroma oil of male leg 1 between before and after treatment except Illness marker of bio impedance, but there is no significant difference of female subjects in aroma oil leg1 except Resistance at 50k, Phase angle at 50k and Illness marker. For leg 2 male subjects Aroma oil has no significant difference except Reactance at 50k and phase angle at 50k, for female subject of aroma leg 2 has significant difference except Phase angle at 50k and Illness marker. Leech oil has significant difference of leg 1 male except Impedance at 5k and Illness marker; there is no significant difference in female subject of leg2 leech except Reactance at 50k, Phase angle at 50k and Illness marker. For Leg 2 male subject has significant difference in leech oil expect Phase Angle at 50k and Illness marker. Finally in last the leg2 of female subjects have no significant difference expect Impedance 5k, Reactance at 50k and Illness marker. By comparing the result between leg 1 and leg 2, leg 1 has significant result.

The table 4.6 below shows that the comparison of Bio Impedance Parameter of Leg 1 between gender, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg1. It is also comparison of gender by used oil before and after treatment. Paired T test shows the comparison of before and after treatment of aroma oil in leg1. There is not enough data for comparing the results of age group 2 and BMI group 4.

Table.4. 6 Paired t-test result for the comparison between Gender, Activity, Age and BMI group of leg 1 before and after treatment using aroma oil

Variables	Over all	Gender(p)		Activity Group(p)			Age Group(p)			BMI Group(p)			
	Leg1	Male	Female	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.000	.556	.135	.000	.000	.000	-	.000	.000	.000	.061	-
Impedance 50k	.000	.000	.085	.085	.000	.000	.000	-	.001	.000	.000	.054	-
Impedance 100k	.000	.000	.228	.228	.000	.000	.000	-	.001	.000	.000	.160	-
Impedance 200k	.000	.000	.724	.724	.000	.000	.000	-	.000	.000	.000	.046	-
Resistance 50k	.000	.000	.011	.011	.000	.021	.000	-	.001	.000	.000	.950	-
Reactance 50k	.000	.000	.197	.197	.000	.001	.000	-	.892	.003	.000	.227	-
Phase Angle50k	.142	.0.19	.006	.006	.769	.000	.033	-	.000	.014	.029	.169	-
Illness marker	.196	.223	.000	.000	.859	.000	.082	-	.580	.867	.570	.000	-

The results of table 4.6 shows there is significant difference in Aroma oil of male leg 1 overall and male subjects except phase angle at 50k and Illness marker of bio impedance parameters, but

there is no significant difference of female subjects and activity group 1 in aroma oil leg1 except Resistance at 50k, Phase angle at 50k and Illness marker. In activity group 2 has significant difference except phase angle at 50 k and Illness marker. Activity group 3 has all significant differences. Age group 1, BMI group 1 and 2 has significant difference except Illness marker, for age group 3 has also significant difference expect reactance at 50k and Illness marker. Finally BMI group 3 has no significant difference expect Impedance at 200k and Illness marker.

The table 4.7 below shows that the comparison of Bio Impedance Parameter of Leg 1 between gender, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment leech oil applied in leg1. It is also comparison of gender by used oil before and after treatment. Paired T test shows the comparison of before and after treatment of leech oil in leg1.

Table.4. 7 Paired t-test result for the comparison between Gender, Activity, Age and BMI group of leg 1 before and after treatment using leech oil

Variables	Over all	Gender(p)		Activity Group(p)			Age Group(p)			BMI Group(p)			
	Leg1	Male	Female	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.090	.156	.003	.348	.101	.747	.189	.001	.000	.000	.037	.328	.000
Impedance 50k	.000	.000	.302	.088	.005	.122	.009	.002	.000	.000	.000	.968	.000
Impedance 100k	.005	.006	.479	.166	.013	.626	.071	.002	.000	.000	.001	.426	.000
Impedance 200k	.017	.015	.616	.302	.010	.973	.181	.001	.000	.000	.003	.277	.000
Resistance 50k	.001	.001	.368	.102	.010	.141	.017	.002	.000	.000	.000	.865	.000
Reactance 50k	.000	.000	.000	.000	.000	.000	.000	.001	.175	.046	.000	.002	.046
Phase Angle50k	.000	.000	.021	.006	.008	.002	.000	.187	.039	.000	.001	.006	.000
Illness marker	.323	.308	.001	.675	.364	.368	.319	.052	.010	.001	.707	.308	.001

The results of table 4.7 shows there is significant difference in leech oil of male leg 1 overall, male subjects and activity group 2 except Impedance at 50k and Illness marker of bio impedance parameters, but there is also significant difference of female subjects in leech oil leg1 except Resistance at 50k and Impedance at 50k 100k and 200k. There is no significant difference in activity group 1 and group 3 except phase angle and reactance at 50k. Age gr group 1 has not significant difference except Impedance; Resistance; reactance and phase angle at 50k. Age group 2 has significant difference expect Phase angle at 50k and Illness marker, for group 3 of age has also significant value expect Reactance and Phase angle at 50k. Finally the groups of BMI 1 and 4 have significant difference, and also in BMI group 2 except Illness marker. There is no significant difference in BMI group 3 except Reactance and Phase angle at 50k.

The table 4.8 below shows that the comparison of Bio Impedance Parameter of Leg 2 between gender, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg2. It is also comparison of gender by used oil before and after treatment. Paired T test shows the comparison of before and after treatment of aroma oil in leg2.

Table.4. 8 Paired t-test result for the comparison between Gender, Activity, Age and BMI group of leg 2 before and after treatment using aroma oil

Variables	Over all	Gender(p)		Activity Group(p)			Age Group(p)			BMI Group(p)			
	Leg2	Male	Female	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.041	.448	.000	.000	.398	.811	.516	.000	.000	.000	.374	.286	.000
Impedance 50k	.001	.060	.000	.001	.003	.856	.091	.000	.000	.000	.001	.858	.000
Impedance 100k	.002	.120	.000	.002	.008	.858	.178	.000	.000	.000	.002	.961	.000
Impedance 200k	.002	.113	.000	.002	.011	.980	.194	.000	.000	.000	.004	.902	.000
Resistance 50k	.001	.071	.000	.001	.004	.863	.107	.000	.000	.000	.001	.879	.000
Reactance 50k	.000	.000	.000	.000	.000	.842	.000	.001	.000	.002	.000	.029	.000
Phase Angle50k	.000	.000	.284	.048	.000	.588	.000	.586	.576	.003	.001	.001	.000
Illness marker	.294	.285	.003	.000	.270	.096	.291	.979	.007	.001	.267	.000	.000

The results of table 4.8 shows there is significant difference in Aroma oil of male leg 2 overall activity group2 and BMI goup2 except Impedance at 50k and Illness marker of bio impedance parameters, but there is no significant difference of male subjects, age group 1 and activity group 3 in aroma oil leg1 except in male subject of Reactance and Phase angle at 50k. Female subject, age group 3 and activity group 1 has significant difference except Phase angle at 50k, for group 2

of age have also significant difference except Phase angle at 50k and Illness marker. The groups of BMI 1 and 3 have significant difference. BMI group 3 has no significant difference except Reactance; Phase angle at 50k and Illness marker.

The table 4.9 below shows that the comparison of Bio Impedance Parameter of Leg 2 between gender, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment leech oil applied in leg2. It is also comparison of gender by used oil before and after treatment. Paired T test shows the comparison of before and after treatment of aroma oil in leg2

Table.4. 9 Paired t-test result for the comparison between Gender, Activity, Age and BMI group of leg 2 before and after treatment using Leech oil

Variables	Over all	Gender(p)		Activity Group(p)			Age Group(p)			BMI Group(p)			
	Leg2	Male	Female	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.000	.043	.000	.000	.001	.000	.000	.001	.019	.000	.016	.000
Impedance 50k	.000	.000	.488	.032	.000	.000	.000	.000	.084	.076	.000	.006	.000
Impedance 100k	.000	.000	.226	.012	.000	.357	.000	.000	.085	.079	.000	.043	.000
Impedance 200k	.000	.000	.197	.006	.000	.000	.000	.000	.085	.077	.000	.007	.000
Resistance 50k	.000	.000	.692	.296	.000	.859	.000	.001	.094	.077	.000	.825	.000
Reactance 50k	.000	.000	.000	.000	.000	.000	.000	.000	.000	.006	.000	.004	.000
Phase Angle50k	.178	.303	.342	.843	.311	.256	.354	.000	.086	.000	.101	.423	.000
Illness marker	.727	.790	.000	.000	.235	.000	.990	.000	.000	.000	.577	.000	.000

The results of table 4.9 shows there is significant difference of leech oil in leg 2 overall, male subjects, activity group 2, BMI group 2 and age group1 except Phase angle at 50k and Illness marker of bio impedance parameters, but there is no significant difference here of female subjects in leech oil leg2 except Reactance at 50k and Illness marker. There is significant difference in activity group 1 and BMI group 3 except Phase angle at 50 k and Resistance at 50k.

In activity group 3 have significant difference Impedance at 100k, Resistance and Phase angle at 50k. For age group 3 have no significant difference except Impedance at 5k, Reactance at 50k and Illness marker. BMI group 1 have significant difference except Impedance at 50k and 100k, resistance 50k, Group 4 of BMI have significant difference in all parameters of BMI.

4.3.1 Statistical Comparison of Bio impedance Parameters for Different Groups – Effect on Gender

In this section has been analysis paired t-test which is used to analysis the significant of bioimpedance parameters before and after treatment between legs and their effect in gender. The paired t-test used to analysis the data of bioimpedance parameters. There are no significant difference when $p>0.05$.Each group have been analysis to see the difference of (p) in each category.

The table 4.10 below shows that the comparison of Bio Impedance Parameter of Leg 1 of male subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil of leg1 in male subjects. There is not enough data for comparing the results of age group 2 and BMI group 4.

Table.4. 10 Paired t-test result for the comparison between Activity, Age and BMI groups of leg1 male subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance	.041	.000	.000	.000	-	.000	.000	.000	.011	-

5k										
Impedance 50k	.106	.000	.000	.000	-	.001	.000	.000	.007	-
Impedance 100k	.100	.000	.000	.000	-	.001	.000	.000	.029	-
Impedance 200k	.077	.000	.000	.000	-	.001	.000	.000	.005	-
Resistance 50k	.112	.000	.021	.000	-	.001	.000	.000	.626	-
Reactance 50k	.279	.000	.001	.000	-	.133	.003	.000	.091	-
Phase Angle 50k	.841	.769	.000	.111	-	.000	.014	.236	.099	-
Illness marker	.263	.859	.000	.288	-	.771	.867	.881	.001	-

Table 4.10 shows the result of Activity, Age and BMI groups of all categories, there is no significant difference in Activity group 1, for group 2 of activity, age group 1 and BMI group 2 has significant difference expect Phase Angle at 50k and Illness marker. Have significant in activity group 3 in all variables and also BMI group 1 except Illness marker. For age group 3have significant difference Reactance at 50k and Illness marker. Finally BMI group 3 has also significant difference except Reactance and Phase angle at 50k and Illness marker.

The table 4.11 below shows that the comparison of Bio Impedance Parameter of Leg 1 of female subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg1. Paired T test shows the comparison of before and after treatment of

aroma oil of leg1 in female subjects. There is not enough data for comparing the results of Activity group2 and3, age group 2 and BMI group 1and 4.

Table.4. 11 Paired t-test result for the comparison of Activity between Age and BMI groups of leg1 female subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.556	-	-	.349	-	.000	-	.010	.000	-
Impedance 50k	.085	-	-	.053	-	.001	-	.775	.000	-
Impedance 100k	.228	-	-	.171	-	.001	-	.110	.000	-
Impedance 200k	.724	-	-	.886	-	.001	-	.001	.000	-
Resistance 50k	.011	-	-	.007	-	.001	-	.153	.000	-
Reactance 50k	.197	-	-	.455	-	.004	-	.537	.000	-
Phase Angle 50k	.006	-	-	.026	-	.000	-	.000	.007	-
Illness marker	.000	-	-	.000	-	.125	-	.003	.002	-

Table 4.11 shows the result of Activity, Age and BMI groups of all categories, there is no significant difference in Activity group 1and Age group1except Reactance, Phase angle at 50k and Illness marker. Have significant difference in age group 3 expect Illness marker. Finally for

BMI group 2 have not significant except Impedance, resistance and Phase angle at 50k, Impedance at 100k, for BMI group have significant difference in all variables of BioImpedance.

The table 4.12 below shows that the comparison of Bio Impedance Parameter of Leg 1 of male subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil of leg1 in male subjects. There is not enough data for comparing the results of age group 2, 3 and BMI group 1and 4.

Table.4. 12 Paired t-test result for the comparison between Activity, Age and BMI groups of leg1 male subjects before and after treatment using Leech oil

Variables	Activity Group(p)			Age Group(p)			BMI Group(p)			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.867	.000	.004	.000	-	-	-	.036	.053	-
Impedance 50k	.000	.000	.000	.000	-	-	-	.000	.000	-
Impedance 100k	.000	.000	.000	.000	-	-	-	.000	.000	-
Impedance 200k	.001	.000	.000	.000	-	-	-	.000	.000	-
Resistance 50k	.000	.000	.000	.000	-	-	-	.000	.000	-
Reactance 50k	.646	.000	.000	.000	-	-	-	.000	.001	-
Phase Angle 50k	.000	.110	.000	.001	-	-	-	.000	.152	-
Illness marker	.231	.308	.425	.166	-	-	-	.352	.112	-

Table 4.12 shows the result of Activity, Age and BMI groups of all categories, there is significant difference in Activity group 1except Impedance at 50k and Illness marker. Have significant difference in Activity group2 expect Illness marker. Foe group 3 of Activity, age group 1 and BMI group 2 has significant difference except illness .Finally for BMI group 3 have significant except Impedance at 5k, Phase angle at 50k and Illness marker. The Comparison of aroma oil and leech oil, leech oil has significant difference in leg1 male subjects.

The table 4.13 below shows that the comparison of Bio Impedance Parameter of Leg 1 of female subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil of leg1 in female subjects. There is not enough data for comparing the results of Activity group 2, 3; Age group 3 and BMI group 1, 2 and 4.

Table.4. 13 Paired t-test result for the comparison between Activity, Age and BMI groups of leg1 female subjects before and after treatment using Leech oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	-	-	.000	.000	-	-	.000	-	-
Impedance 50k	.007	-	-	.000	.000	-	-	.000	-	-
Impedance 100k	.030	-	-	.000	.000	-	-	.000	-	-
Impedance 200k	.201	-	-	.000	.000	-	-	.000	-	-
Resistance 50k	.012	-	-	.000	.000	-	-	.000	-	-
Reactance 50k	.013	-	-	.000	.000	-	-	.005	-	-
Phase Angle 50k	.000	-	-	.000	.000	-	-	.061	-	-
Illness marker	.006	-	-	.034	.000	-	-	.009	-	-

Table 4.13 shows the result of Activity, Age and BMI groups of all categories. There is significant difference in all categories of groups except Activity group 1 at Impedance 200k and BMI group 2 at Phase angle 50k. The Comparison of aroma oil and leech oil, leech oil has significant difference in leg1female subjects.

The table 4.14 below shows that the comparison of Bio Impedance Parameter of Leg 2 of male subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in male subjects.

Table.4. 14 Paired t-test result for the comparison between Activity, Age and BMI groups of leg2 male subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.133	.735	.811	.934	.000	.000	.000	.495	.286	.000
Impedance 50k	.365	.023	.856	.317	.000	.000	.000	.272	.858	.000
Impedance 100k	.497	.051	.858	.502	.000	.000	.000	.449	.961	.000
Impedance 200k	.532	.065	.980	.490	.000	.000	.000	.519	.902	.000
Resistance 50k	.385	.028	.863	.356	.000	.000	.000	.312	.879	.000
Reactance 50k	.005	.000	.842	.000	.000	.005	.002	.001	.029	.000
Phase Angle 50k	.000	.000	.588	.000	.033	.573	.003	.002	.001	.000
Illness marker	.000	.268	.096	.284	.621	.354	.001	.259	.000	.000

Table 4.14 shows the result of Activity, Age and BMI groups of all categories. There is no significant difference in Activity group 1 and BMI group 3 except Reactance, Phase Angle at 50k and Illness marker. Have significant difference in Activity group 2 except Impedance at 5k, 100k and 200k, Illness marker too. None of significant difference here in Activity group 3. Age group 1 and BMI group 2 has also no significant difference. Age group 2 has significant

difference except Illness marker and in age group 3 have also significant difference except Phase angle at 50k, Illness marker too. Finally the groups of BMI 1 and 4 have significant difference.

The table 4.15 below shows that the comparison of Bio Impedance Parameter of Leg 2 of female subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in female subjects. There is not enough data for comparing the results of BMI groups 1, 2 and 4.

Table.4. 15 Paired t-test result for the comparison of Activity, Age and BMI groups of leg2 female subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.000	.000	.000	.001	.000	-	.000	-	-
Impedance 50k	.000	.000	.001	.001	.000	.000	-	.000	-	-
Impedance 100k	.000	.000	.001	.001	.000	.000	-	.000	-	-
Impedance 200k	.000	.000	.003	.003	.000	.000	-	.000	-	-
Resistance 50k	.000	.000	.001	.001	.000	.000	-	.000	-	-
Reactance 50k	.000	.000	.000	.000	.029	.002	-	.000	-	-
Phase Angle 50k	.728	.000	.185	.185	.892	.000	-	.284	-	-
Illness marker	.024	.000	.016	.016	.894	.001	-	.003	-	-

Table 4.15 shows the result of Activity, Age and BMI groups of all categories. All variables have significant difference except Phase Angle at 50 k and it has significant difference in Activity group 2, Age group 3 and Illness marker in Age group 2.

The table 4.16 below shows that the comparison of Bio Impedance Parameter of Leg 2 of male subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis

data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in male subjects. There is not enough data for comparing the results of age group 2 and BMI group 4.

Table.4. 16 Paired t-test result for the comparison between Activity, Age and BMI groups of leg2 male subjects before and after treatment using Leech oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.000	.000	.000	-	.000	.000	.000	.000	-
Impedance 50k	.000	.000	.000	.000	-	.000	.000	.000	.000	-
Impedance 100k	.000	.000	.048	.000	-	.000	.000	.000	.000	-
Impedance 200k	.000	.000	.000	.000	-	.000	.000	.000	.000	-
Resistance 50k	.000	.000	.120	.000	-	.000	.000	.000	.016	-
Reactance 50k	.000	.000	.000	.000	-	.000	.001	.000	.000	-
Phase Angle 50k	.000	.000	.754	.000	-	.000	.000	.000	.000	-
Illness marker	.000	.227	.000	.007	-	.000	.000	.071	.000	-

Table 4.16 shows the result of Activity, Age and BMI groups of all categories. All variables have significant difference except Phase Angle at 50 k in Activity group 3 and Illness marker in age group 2, BMI group 2 too. By comparing the results of leech oil with aroma cream, Leech oil has significant difference in leg2 male subjects.

The table 4.17 below shows that the comparison of Bio Impedance Parameter of Leg 2 of female subjects between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in female subjects. There is not enough data for comparing the results of Activity group 2, 3; age group 2, 3 and BMI group 1, 3 and 4.

Table.4. 17 Paired t-test result for the comparison of Activity, Age and BMI groups of leg2 female subjects before and after treatment using Leech oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	-	-	.000	-	-	-	.000	-	-
Impedance 50k	.000	-	-	.000	-	-	-	.000	-	-
Impedance 100k	.000	-	-	.000	-	-	-	.000	-	-
Impedance 200k	.000	-	-	.000	-	-	-	.000	-	-
Resistance 50k	.001	-	-	.005	-	-	-	.031	-	-
Reactance 50k	.000	-	-	.000	-	-	-	.000	-	-
Phase Angle 50k	.000	-	-	.000	-	-	-	.000	-	-
Illness marker	.000	-	-	.000	-	-	-	.000	-	-

Table 4.17 shows the result of Activity, Age and BMI groups of all categories. All variables have significant. By comparing the results of leech oil with aroma cream, Leech oil has significant difference in leg2 female subjects.

4.4 Statistical Comparison of Bio impedance Parameters between different groups

In this section the statistical comparison of Bioimpedance parameters are between 3 Groups (Activity, Age and BMI) with different legs and different oils. Each group has more than three

two groups so; here one way Anova is used to analysis data and Post HOC test to know that which category of group has higher difference of p. The result of the Anova test on the analysis of bioimpedance parameters are shown below tables. There are no significant difference when p>0.05.

The table 4.18 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of aroma oil of leg1 and leg 2, If the p>0.05 then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has.

Table.4. 18 One way Anova results for the comparison of Activity, Age and BMI groups of leg1and leg2 using Aroma oil

Variables	Group of Activity (p)		Group of Age (p)		Group of BMI (p)	
	Leg 1	Leg 2	Leg 1	Leg2	Leg 1	Leg2
Impedance 5K	.000	.377	.788	.381	.000	.114
Impedance 50K	.004	.031	.248	.232	.000	.000
Impedance 100K	.018	.026	.027	.217	.000	.000
Impedance 200K	.002	.018	.004	.227	.000	.000
Resistance 50K	.009	.032	.498	.228	.000	.000
Reactance 50 K	.000	.091	.007	.008	.000	.003
Phase Angle50K	.051	.005	.000	.000	.045	.005
Illness marker	.000	.424	.000	.896	.500	.754

Table 4.18 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg 1 have significant difference except in Phase angle at 50k, for leg2

have significant difference except Impedance at 5k, Reactance at 50 k and Illness marker, by comparing both leg in this group leg 1 have significant differences using aroma oil. For Age group leg 1 has significant differences except Impedance at 5k and reactance at 50k, in leg 2 has no significant difference except reactance and Phase angle at 50k, by comparing both leg in this group leg 1 have significant differences using aroma oil. Group of BMI of leg 1 has significant differences except Illness marker and for leg2 has significant difference too except Impedance at 5 k and Illness marker, by comparing both leg in this group leg 1 have significant differences using aroma oil. If the value of p>.05 to see in which category of group have higher value use Post HOC test Refer to A1 and A2.

The table 4.19 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of aroma oil of leg1 and leg 2 for male subjects, If the p>0.05 then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has.

Table 4.19 One way Anova results for the comparison between Activity, Age and BMI groups of leg1and leg2 male subjects using Aroma oil

Variables	Group of Activity (p)		Group of Age (p)		Group of BMI (p)	
	Leg 1	Leg 2	Leg 1	Leg2	Leg 1	Leg2
Impedance 5K	.035	.174	.926	.975	.000	.014
Impedance 50K	.066	.498	.377	.846	.000	.000
Impedance 100K	.581	.489	.017	.803	.000	.000
Impedance 200K	.009	.518	.005	.746	.001	.000
Resistance 50K	.298	.487	.465	.850	.000	.000
Reactance 50 K	.004	.276	.012	.038	.000	.000
Phase Angle50 K	.189	.027	.000	.000	.098	.010
Illness marker	.004	.525	.000	.945	.141	.633

Table 4.19 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg 1male subjects has not significant difference except in Impedance at 5k 200k and Reactance at 50k, for leg2 male subjects has not significant difference except at Phase angle 50k, by comparing both leg in this group leg 1 have significant differences using aroma oil. For Age group leg 1 male subject has significant differences except Impedance at 5k, 50k and resistance at 50k, in leg 2 has no significant difference except Phase angle at 50k, by comparing both leg in this group leg 1 have significant differences using aroma oil. Group of BMI of leg 1male subjects has significant differences except Phase angle and Illness marker and for leg 2 have significant differences except Illness marker, by comparing both legs Leg 2 has

significant result of male subject using aroma. If the value of p>.05 to see in which category of group have higher value use Post HOC test Refer to A3 and A4.

The table 4.20 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of aroma oil of leg1 and leg 2 for female subjects, If the p>0.05 then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has. There is no enough data by comparing the result of Leg 1 in Group of Activity and Leg 2 in Group of BMI.

Table.4.20 One way Anova results for the comparison between Activity, Age and BMI groups of leg1and leg2 female subjects using Aroma oil

Variables	Group of Activity (p)		Group of Age (p)		Group of BMI (p)	
	Leg 1	Leg 2	Leg 1	Leg2	Leg 1	Leg2
Impedance 5K	-	.000	.261	.093	.000	-
Impedance 50K	-	.000	.328	.065	.000	-
Impedance 100K	-	.000	.000	.062	.000	-
Impedance 200K	-	.000	.827	.054	.002	-
Resistance 50K	-	.000	.003	.065	.000	-
Reactance 50 K	-	.000	.827	.444	.000	-
Phase Angle50 K	-	.000	.111	.001	.000	-
Illness marker	-	.000	.338	.000	.461	-

Table 4.20 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg2 female subjects has significant. For Age group leg 1 female subject has not significant differences except Impedance at 100k and resistance at 50k, in leg 2 has no significant difference in Phase angle at 50k and Illness marker, by comparing both leg in this group both has not difference using aroma oil. Group of BMI of leg1 female subjects has significant differences except Illness marker.

The table 4.21 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of leech oil of leg1 and leg 2, If the $p>0.05$ then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has.

Table.4.21 One way Anova results for the comparison between Activity, Age and BMI groups of leg1and leg2 using Leech oil

Variables	Group of Activity (p)		Group of Age (p)		Group of BMI (p)	
	Leg 1	Leg 2	Leg 1	Leg2	Leg 1	Leg2
Impedance 5K	.038	.022	.633	.727	.070	.000
Impedance 50K	.002	.017	.211	.309	.000	.000
Impedance 100K	.001	.000	.266	.040	.000	.000
Impedance 200K	.000	.074	.282	.010	.000	.000
Resistance 50K	.002	.002	.225	.719	.000	.000
Reactance 50 K	.024	.000	.003	.006	.000	.002
Phase Angle50 K	.019	.000	.021	.003	.005	.630
Illness marker	.768	.200	.783	.934	.958	.629

Table 4.21 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg 1 subjects has significant difference except in Illness marker, for leg2 subjects has also significant difference except Impedance 200k Illness marker, by comparing both leg in this group leg 1 have significant differences using leech oil. For Age group leg 1 subject has no significant difference except Phase angle at 50k and reactance at 50k, in leg 2 has significant except Impedance at 100k and 200k ,Reactance and Phase angle at 50k, by comparing both leg in this group leg 2 have significant differences using Leech oil. The leg1 Group of BMI has significant differences except Impedance at 5k and Illness marker. If the value

of p>.05 to see in which category of group have higher value use Post HOC test Refer to A5 and A6.

The table 4.22 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of leech oil of leg1 and leg 2 male subjects, If the p>0.05 then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has.

Table.4. 22 One way Anova results for the comparison between Activity, Age and BMI groups of leg1and leg2 male subjects using Leech oil

Variables	Group of Activity (p)		Group of Age (p)		Group of BMI (p)	
	Leg 1	Leg 2	Leg 1	Leg2	Leg 1	Leg2
Impedance 5K	.503	.121	.796	.707	.007	.004
Impedance 50K	.956	.099	.273	.365	.000	.000
Impedance 100K	.967	.001	.292	.022	.000	.000
Impedance 200K	.821	.153	.293	.013	.000	.010
Resistance 50K	.962	.017	.276	.595	.000	.000
Reactance 50 K	.127	.001	.030	.002	.000	.014
Phase Angle50 K	.117	.001	.026	.001	.010	.459
Illness marker	.499	.300	.889	.945	.975	.574

Table 4.22 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg 1 subjects has no significant difference, for leg2 subjects has significant difference except Impedance at 5k, 50k and 200k, Illness marker. The comparisons

both leg in this group leg 2 have significant differences using leech oil. For Age group leg 1 subject has no significant difference except Phase angle and reactance at 50k, in leg 2 has significant except Impedance at 5k and 50k ,Resistance and Phase angle at 50k, by comparing both leg in this group leg 2 have significant differences using Leech oil. The leg 1 of BMI Group has significant differences Illness marker and for leg2 have also significant difference except Phase angle at 50k and Illness marker. If the value of p>.05 to see in which category of group has higher value to use Post HOC test Refer to A7 and A8.

The table 4.23 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of leech oil of leg1 and leg 2 female subjects, If the p>0.05 then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has. There is not enough data by comparing the result of Leg 2 in Group of Activity and Leg 1 in Group of BMI.

Table.4.23 One way Anova results for the comparison between Activity, Age and BMI groups of leg1and leg2 male subjects using Leech oil

Variables	Group of Activity (p)		Group of Age (p)		Group of BMI (p)	
	Leg 1	Leg 2	Leg 1	Leg2	Leg 1	Leg2
Impedance 5K	.000	-	.013	.227	-	.000
Impedance 50K	.000	-	.004	.366	-	.000
Impedance 100K	.000	-	.003	.026	-	.000
Impedance 200K	.000	-	.001	.834	-	.000
Resistance 50K	.000	-	.003	.071	-	.000
Reactance 50 K	.763	-	.671	.465	-	.000
Phase Angle50 K	.000	-	.000	.478	-	.888
Illness marker	.000	-	.000	.003	-	.229

Table 4.23 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg 1 subjects has significant difference except in reactance at 50k. For Age group leg 1 subject has significant difference except reactance at 50k, in leg 2 has no significant except Impedance at 100k and Illness marker, by comparing both leg in this group leg 1 have significant differences using Leech oil in female subjects. The leg2 have also significant difference except Phase angle at 50k and Illness marker. If the value of p>.05 to see in which category of group has higher value to use Post HOC test Refer to A9.

4.4.1 Statistical Comparison of Bio impedance Parameters – Effect on Genders

In this section the statistical comparison of Bioimpedance parameters are between 3 Groups (Activity, Age and BMI) with different legs and different oils with effect on genders. Each group has more than three two groups so; here one way Anova is used to analysis data and Post HOC

test to know that which category of group has higher difference of p. The result of the Anova test on the analysis of bioimpedance parameters are shown below tables with effect on genders. There are no significant difference when p>0.05.

The table 4.24 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of Aroma oil of leg1 and leg 2 male and female subjects, If the p>0.05 then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has. There is no enough data of female to analysis the results in Group of Activity leg1 and Group of BMI leg2

Table.4. 24 One way Anova results for the comparison between Activity, Age and BMI groups of leg1and leg2 effect on gender using aroma oil

Variables	Group of Activity (p)				Group of Age (p)				Group of BMI (p)			
	Leg 1		Leg 2		Leg 1		Leg2		Leg 1		Leg2	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Impedance 5K	.035	-	.174	.000	.926	.261	.975	.093	.000	.000	.014	-
Impedance 50K	.066	-	.498	.000	.377	.328	.846	.065	.000	.000	.000	-
Impedance 100K	.581	-	.489	.000	.017	.000	.803	.062	.000	.000	.000	-
Impedance 200K	.009	-	.518	.000	.005	.827	.746	.054	.001	.002	.000	-
Resistance 50K	.298	-	.487	.000	.465	.003	.850	.065	.000	.000	.000	-
Reactance 50 K	.004	-	.276	.000	.012	.827	.038	.444	.000	.000	.000	-
Phase Angle50 K	.189	-	.027	.000	.000	.111	.000	.001	.098	.000	.010	-
Illness marker	.004	-	.525	.000	.000	.338	.945	.000	.141	.461	.633	-

Table 4.24 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg 1 male subjects has no significant difference except in Impedance at 50k and 100k, Reactance and Phase Angle at 50k, in leg2 there is no significant difference except Phase Angle at 50k. For Age group leg 1 male subjects has significant difference except Impedance at 5k, 50k and 200k, resistance at 50k too, leg 1 female subjects has no significant difference except in Impedance 100k and Resistance at 50k, in leg 2 of male subject has no significant except in Reactance and Phase angle at 50k, Leg 2 for male has no significant difference except in Phase Angle in 50k and Illness marker. The Group of BMI in Leg 1 male subject has significant value expect Phase Angle at 50k and Illness marker. The leg1 of female and leg 2 of male has significant difference except Illness marker. If the value of p>.05 to see in which category of group has higher value to use Post HOC test Refer to A3 and A4.

The table 4.25 below shows that the comparison of Bio Impedance Parameter between Activity groups, age groups and BMI groups. One way Anova test is used to analysis data. Anova test shows the comparison between 3 Groups (Activity, Age and BMI) after treatment of leech oil of leg1 and leg 2 male and female subjects, If the p>0.05 then no significant difference. Post HOC test also analysis to know in which category of groups higher difference has. There is no enough data of female to analysis the results in Group of Activity leg2 and Group of BMI leg1.

Table.4. 25 One way Anova results for the comparison between Activity, Age and BMI groups of leg1and leg2 effect on gender using Leech oil

Variables	Group of Activity (p)				Group of Age (p)				Group of BMI (p)			
	Leg 1		Leg 2		Leg 1		Leg2		Leg 1		Leg2	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Impedance 5K	.503	.000	.121	-	.796	.013	.707	.227	.007	-	.004	.000
Impedance 50K	.956	.000	.099	-	.273	.004	.365	.366	.000	-	.000	.000
Impedance 100K	.967	.000	.001	-	.292	.003	.022	.026	.000	-	.000	.000
Impedance 200K	.821	.000	.153	-	.293	.001	.013	.834	.000	-	.010	.000
Resistance 50K	.962	.000	.017	-	.276	.003	.595	.071	.000	-	.000	.000
Reactance 50 K	.127	.763	.001	-	.030	.671	.002	.465	.000	-	.014	.000
Phase Angle50 K	.117	.000	.001	-	.026	.000	.001	.478	.010	-	.459	.888
Illness marker	.499	.000	.300	-	.889	.000	.945	.003	.975	-	.574	.229

Table 4.25 shows 1 the results of Bio Impedance Parameters between different criteria of Groups. Group of activity leg 1 male subjects has no significant difference, for female subject of leg 1 has significant difference except Reactance at 50k, in leg2 there is significant difference except in Impedance at 5k, 50k and 200k, Illness marker too. For Age group leg 1 male subjects has no significant difference except Rea 50k, leg 1 female subjects has significant difference except in Reactance at 50k, in leg 2 of male subject has significant except in Impedance at 5k and 50k, Resistance at 50 k and Illness, Leg 2 for female has no significant difference except in Impedance at 100k and Illness marker. The Group of BMI in Leg 1 male subject has significant

value expect in Illness marker. The leg2 of male and leg 2 of female has significant difference except Phase Angle Illness marker. If the value of p>.05 to see in which category of group has higher value to use Post HOC test Refer to A7, A8 and A9.

4.5 Statistical Comparison of Bio impedance Parameters – Effect of oils

In this section the statistical comparison of Bioimpedance parameters are between Aroma oil and leech oil with different legs with effect on genders. Independence T test is used for to analysis the data. There are no significant difference when p>0.05. Independence T Test also shows the Means Value Aroma oil and leech for comparison.

The table 4.26 below shows that the comparison of Bio Impedance Parameter of leg 1 and leg2 between Aroma oil and leech oil.

Independence T test is used for to analysis the data, it is two values, and one of them is equal variance assumed and second is equally variance not assumed also shows the Means Value Aroma oil and leech for comparison.

Table.4. 26 Independent t-test result for the comparison of Aroma oil and leech oil of both legs

Bio Impedance Parameters	Leg 1			Leg 2		
	Aroma and Leech (p)	Mean		Aroma and Leech (p)	Mean	
		Aroma	Leech		Aroma	Leech
Impedance 5k	.022	242.7760	224.9600	.003	224.2880	240.5040
Impedance 50k	.000	206.8480	191.2400	.001	193.6240	207.6080
Impedance 100k	.014	188.8960	178.7520	.136	181.4640	187.5040
Impedance 200k	.000	189.94	171.44	.000	174.58	191.32
Resistance 50k	.004	202.3280	189.8720	.028	192.3520	201.5040
Reactance 50k	.508	22.4864	22.0600	.059	21.6248	22.7696
Phase Angle 50k	.002	6.2096	6.6440	.118	6.4224	6.2584
Illness marker	.146	.7661	1.0588	.856	.8602	.8408

Note: the p in parentheses is Equal variance not assumed.

Table 4.26 the result shows the Bio Impedance Parameters between Leg1 and leg2 with effect of Aroma oil and leech. There are significant results of comparison of Aroma oil and Leech except Reactance at 50 and Illness marker. The Means value of Aroma oil in Reactance 50k is higher than Leech oil but in Illness marker Leech value is higher comparatively Aroma oil. In leg two there is significant expect Impedance at 100k, Reactance and Phase angle at 50k, Illness marker

too. The Means Value of Leech in leg 2 at Impedance 100k and Reactance 50k is higher than Aroma oil but in Phase Angle and Illness marker mean of leech is lower than Aroma oil.

Table 4.27 below shows that the comparison of Bio Impedance Parameter of Leg 1 and Leg2 between Aroma oil and leech oil. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment two of the oils aroma and leech were applied on the both legs. Paired T test shows the comparison of before and after treatment.

Table.4. 27 Paired t-test result for the comparison Aroma oil and leech oil in genders of both legs before and after Aroma oil and leech oil

Bio Impedance Parameters	Leg 1				Leg 2			
	Male		Female		Male		Female	
	Aroma	Leech	Aroma	Leech	Aroma	Leech	Aroma	Leech
Impedance 5k	.000	.156	.556	.003	.448	.000	.000	.043
Impedance 50k	.000	.000	.085	.302	.060	.000	.000	.488
Impedance 100k	.000	.006	.228	.479	.120	.000	.000	.226
Impedance 200k	.000	.015	.724	.616	.113	.000	.000	.197
Resistance 50k	.000	.001	.011	.368	.071	.000	.000	.692
Reactance 50k	.000	.000	.197	.000	.000	.000	.000	.000
Phase Angle 50k	.019	.000	.006	.021	.000	.303	.284	.342
Illness marker	.223	.308	.000	.001	.285	.790	.003	.000

The result of table 4.27 shows there is significant difference in Aroma oil of male leg 1 between before and after treatment except Illness marker of bio impedance, but there is no significant difference of female subjects in aroma oil leg1 except Resistance at 50k, Phase angle at 50k and Illness marker. For leg 2 male subjects Aroma oil has no significant difference except Reactance at 50k and phase angle at 50k, for female subject of aroma leg 2 has significant difference except Phase angle at 50k and Illness marker. Leech oil has significant difference of leg 1 male except Impedance at 5k and Illness marker; there is no significant difference in female subject of leg2 leech except Reactance at 50k, Phase angle at 50k and Illness marker. For Leg 2 male subject has significant difference in leech oil expect Phase Angle at 50k and Illness marker. Finally in last the leg2 of female subjects have not significant difference expect Impedance 5k, Reactance at 50k and Illness marker. By comparing the results in leg1 male and female no difference between both oils, but in leg2 male subject in Leech oil have significant value with comparing with Aroma oil and in female subject Aroma oil has significant difference with comparing Leech oil.

The table 4.28 below shows that the comparison of Bio Impedance Parameter of Leg 1 between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil in leg1. There is not enough data for comparing the results of age group 2 and BMI group 4.

Table.4. 28 Paired t-test result for the comparison in, Activity, Age and BMI group of leg 1 before and after treatment using aroma oil

Variables	Activity Group(p)			Age Group(p)			BMI Group(p)			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.135	.000	.000	.000	-	.000	.000	.000	.061	-
Impedance 50k	.085	.000	.000	.000	-	.001	.000	.000	.054	-
Impedance 100k	.228	.000	.000	.000	-	.001	.000	.000	.160	-
Impedance 200k	.724	.000	.000	.000	-	.000	.000	.000	.046	-
Resistance 50k	.011	.000	.021	.000	-	.001	.000	.000	.950	-
Reactance 50k	.197	.000	.001	.000	-	.892	.003	.000	.227	-
Phase Angle50k	.006	.769	.000	.033	-	.000	.014	.029	.169	-
Illness marker	.000	.859	.000	.082	-	.580	.867	.570	.000	-

The results of table 4.28 shows there is significant difference in Aroma oil. There is no significant difference activity group 1 in aroma oil leg1 except Resistance at 50k, Phase angle at 50k and Illness marker, activity group 2 has significant difference except phase angle at 50 k and

Illness marker. Activity group 3 has all significant differences. Age gr group 1, BMI group 1 and 2 has significant difference except Illness marker, for age group 3 has also significant difference expect reactance at 50k and Illness marker. Finally BMI group 3 has no significant difference expect Impedance at 200k and Illness marker.

The table 4.29 below shows that the comparison of Bio Impedance Parameter of Leg 1 between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment leech oil applied in leg1. Paired T test shows the comparison of before and after treatment of leech oil in leg1.

Table.4. 29 Paired t-test result for the comparison between Activity, Age and BMI groups of leg 1 before and after treatment using leech oil

Variables	Activity Group(p)			Age Group(p)			BMI Group(p)			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.348	.101	.747	.189	.001	.000	.000	.037	.328	.000
Impedance 50k	.088	.005	.122	.009	.002	.000	.000	.000	.968	.000
Impedance 100k	.166	.013	.626	.071	.002	.000	.000	.001	.426	.000
Impedance 200k	.302	.010	.973	.181	.001	.000	.000	.003	.277	.000
Resistance 50k	.102	.010	.141	.017	.002	.000	.000	.000	.865	.000
Reactance 50k	.000	.000	.000	.000	.001	.175	.046	.000	.002	.046
Phase Angle50k	.006	.008	.002	.000	.187	.039	.000	.001	.006	.000
Illness marker	.675	.364	.368	.319	.052	.010	.001	.707	.308	.001

The results of table 4.29 shows there is significant difference in leech oil activity group 2 except Impedance at 50k and Illness marker of bio impedance parameters, no significant difference in activity group 1 and group 3 except phase angle at 50 k and reactance at 50k. Age gr group 1 has not significant difference except Impedance; Resistance; reactance and phase angle at 50k. Age

group 2 has significant difference expect Phase angle at 50 and Illness marker, for group 3 of age has also significant value expect Reactance and Phase angle at 50k. Finally the groups of BMI 1 and 4 have significant difference, and also in BMI group 2 except Illness marker. There is no significant difference in BMI group 3 except Reactance and Phase angle at 50k.

The table 4.30 below shows that the comparison of Bio Impedance Parameter of Leg 2 between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil in leg2.

Table.4. 30 Paired t-test result for the comparison in Activity, Age and BMI groups of leg 2 before and after treatment using aroma oil

Variables	Activity Group(p)			Age Group(p)			BMI Group(p)			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.398	.811	.516	.000	.000	.000	.374	.286	.000
Impedance 50k	.001	.003	.856	.091	.000	.000	.000	.001	.858	.000
Impedance 100k	.002	.008	.858	.178	.000	.000	.000	.002	.961	.000
Impedance 200k	.002	.011	.980	.194	.000	.000	.000	.004	.902	.000
Resistance 50k	.001	.004	.863	.107	.000	.000	.000	.001	.879	.000
Reactance 50k	.000	.000	.842	.000	.001	.000	.002	.000	.029	.000
Phase Angle50k	.048	.000	.588	.000	.586	.576	.003	.001	.001	.000
Illness marker	.000	.270	.096	.291	.979	.007	.001	.267	.000	.000

The results of table 4.30 shows there is significant difference in Aroma oil of leg 2 activity group2 and BMI group 2 except Impedance at 50k and Illness marker of bio impedance parameters, but there is no significant difference in age group 1 and activity group 3 in aroma oil leg1 except of Reactance and Phase angle at 50k. Age group 3 and activity group 1 has significant difference except Phase angle at 50k, for group 2 of age have also significant

difference except Phase angle at 50k and Illness marker. The groups of BMI 1 and 3 have significant difference. BMI group 3 has no significant difference except Reactance; Phase angle at 50k and Illness marker.

The table 4.31 below shows that the comparison of Bio Impedance Parameter of Leg 2 between Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment leech oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil in leg2 Illness marker.

Table.4. 31 Paired t-test result for the comparison between Activity, Age and BMI group of leg 2 before and after treatment using Leech oil

Variables	Activity Group(p)			Age Group(p)			BMI Group(p)			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.000	.001	.000	-	.001	.019	.000	.016	-
Impedance 50k	.032	.000	.000	.000	-	.084	.076	.000	.006	-
Impedance 100k	.012	.000	.357	.000	-	.085	.079	.000	.043	-
Impedance 200k	.006	.000	.000	.000	-	.085	.077	.000	.007	-
Resistance 50k	.296	.000	.859	.000	-	.094	.077	.000	.825	-
Reactance 50k	.000	.000	.000	.000	-	.000	.006	.000	.004	-
Phase Angle50k	.843	.311	.256	.354	-	.086	.000	.101	.423	-
Illness marker	.000	.235	.000	.990	-	.000	.000	.577	.000	-

The results of table 4.31 shows there is significant difference of leech oil in leg 2 between Activity group 2, BMI group 2 and age group1 except Phase angle at 50k and Illness marker of bio impedance parameters. There is significant difference in activity group 1 and BMI group 3 except Phase angle at 50 k and Resistance at 50k. In activity group 3 have significant difference

Impedance at 100k, Resistance and Phase angle at 50k. For age group 3 have no significant difference except Impedance at 5k, Reactance at 50k and Illness marker. BMI group 1 have significant difference except Impedance at 50k and 100k, resistance 50k, Group 4 of BMI have significant difference in all parameters of BMI.

4.5.1 Statistical Comparison of Bio impedance Parameters between Aroma Oil and Leech oil in different Groups

In this section has been analysis paired t-test which is used to analysis the significant of bioimpedance parameters before and after treatment between legs and their effect in gender. The paired t-test used to analysis the data of bioimpedance parameters. There are no significant difference when $p>0.05$.Each group have been analysis to see the difference of (p) in each category.

The table 4.32 below shows that the comparison of Bio Impedance Parameter of Leg 1 of male subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil of leg1 in male subjects. There is not enough data for comparing the results of age group 2 and BMI group 4.

Table.4. 32 Paired t-test result for the comparison of Activity, Age and BMI groups of leg1 male subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.041	.000	.000	.000	-	.000	.000	.000	.011	-
Impedance 50k	.106	.000	.000	.000	-	.001	.000	.000	.007	-
Impedance 100k	.100	.000	.000	.000	-	.001	.000	.000	.029	-
Impedance 200k	.077	.000	.000	.000	-	.001	.000	.000	.005	-
Resistance 50k	.112	.000	.021	.000	-	.001	.000	.000	.626	-
Reactance 50k	.279	.000	.001	.000	-	.133	.003	.000	.091	-
Phase Angle 50k	.841	.769	.000	.111	-	.000	.014	.236	.099	-
Illness marker	.263	.859	.000	.288	-	.771	.867	.881	.001	-

Table 4.32 shows the result of Activity, Age and BMI groups of all categories, there is no significant difference in Activity group 1, for group 2 of activity, age group 1 and BMI group 2 has significant difference expect Phase Angle at 50k and Illness marker. Have significant in activity group 3 in all variables and also BMI group 1 except Illness marker. For age group 3have significant difference Reactance at 50k and Illness marker. Finally BMI group 3 has also significant difference except Reactance and Phase angle at 50k and Illness marker.

The table 4.33 below shows that the comparison of Bio Impedance Parameter of Leg 1 of female subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil of leg1 in female subjects. There is not enough data for comparing the results of Activity group2 and 3, age group 2 and BMI group 1and 4.

Table.4. 33 Paired t-test result for the comparison of Activity, Age and BMI groups of leg1 female subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.556	-	-	.349	-	.000	-	.010	.000	-
Impedance 50k	.085	-	-	.053	-	.001	-	.775	.000	-
Impedance 100k	.228	-	-	.171	-	.001	-	.110	.000	-
Impedance 200k	.724	-	-	.886	-	.001	-	.001	.000	-
Resistance 50k	.011	-	-	.007	-	.001	-	.153	.000	-
Reactance 50k	.197	-	-	.455	-	.004	-	.537	.000	-
Phase Angle 50k	.006	-	-	.026	-	.000	-	.000	.007	-
Illness marker	.000	-	-	.000	-	.125	-	.003	.002	-

Table 4.33 shows the result of Activity, Age and BMI groups of all categories, there is no significant difference in Activity group 1and Age group1except Reactance, Phase angle at 50k and Illness marker. Have significant difference in age group 3 expect Illness marker. Finally for BMI group 2 have not significant except Impedance, resistance and Phase angle at 50k, Impedance at 100k, for BMI group have significant difference in all variables of BioImpedance.

The table 4.34 below shows that the comparison of Bio Impedance Parameter of Leg 1 of male subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil of leg1 in male subjects. There is not enough data for comparing the results of age group 2, 3 and BMI group 1and 4.

Table.4. 34 Paired t-test result for the comparison of Activity, Age and BMI groups of leg1 male subjects before and after treatment using Leech oil

Variables	Activity Group(p)			Age Group(p)			BMI Group(p)			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.867	.000	.004	.000	-	-	-	.036	.053	-
Impedance 50k	.000	.000	.000	.000	-	-	-	.000	.000	-
Impedance 100k	.000	.000	.000	.000	-	-	-	.000	.000	-
Impedance 200k	.001	.000	.000	.000	-	-	-	.000	.000	-
Resistance 50k	.000	.000	.000	.000	-	-	-	.000	.000	-
Reactance 50k	.646	.000	.000	.000	-	-	-	.000	.001	-
Phase Angle 50k	.000	.110	.000	.001	-	-	-	.000	.152	-
Illness marker	.231	.308	.425	.166	-	-	-	.352	.112	-

Table 4.34 shows the result of Activity, Age and BMI groups of all categories, there is significant difference in Activity group 1except Impedance at 50k and Illness marker. Have significant difference in Activity group2 expect Illness marker. Foe group 3 of Activity, age group 1 and BMI group 2 has significant difference except illness .Finally for BMI group 3 have significant except Impedance at 5k, Phase angle at 50k and Illness marker. The Comparison of aroma oil and leech oil, leech oil has significant difference in leg1 male subjects.

The table 4.35 below shows that the comparison of Bio Impedance Parameter of Leg 1 of female subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil applied in leg1. Paired T test shows the comparison of before and after treatment of aroma oil of leg1 in female subjects. There is not enough data for comparing the results of Activity group 2, 3; Age group 3 and BMI group 1, 2 and 4.

Table.4. 35 Paired t-test result for the comparison of Activity, Age and BMI groups of leg1 female subjects before and after treatment using Leech oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	-	-	.000	.000	-	-	.000	-	-
Impedance 50k	.007	-	-	.000	.000	-	-	.000	-	-
Impedance 100k	.030	-	-	.000	.000	-	-	.000	-	-
Impedance 200k	.201	-	-	.000	.000	-	-	.000	-	-
Resistance 50k	.012	-	-	.000	.000	-	-	.000	-	-
Reactance 50k	.013	-	-	.000	.000	-	-	.005	-	-
Phase Angle 50k	.000	-	-	.000	.000	-	-	.061	-	-
Illness marker	.006	-	-	.034	.000	-	-	.009	-	-

Table 4.35 shows the result of Activity, Age and BMI groups of all categories. There is significant difference in all categories of groups except Activity group 1 at Impedance 200k and BMI group 2 at Phase angle 50k. The Comparison of aroma oil and leech oil, leech oil has significant difference in leg1female subjects.

The table 4.36 below shows that the comparison of Bio Impedance Parameter of Leg 2 of male subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in male subjects.

Table.4. 36 Paired t-test result for the comparison of Activity, Age and BMI groups of leg2 male subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.133	.735	.811	.934	.000	.000	.000	.495	.286	.000
Impedance 50k	.365	.023	.856	.317	.000	.000	.000	.272	.858	.000
Impedance 100k	.497	.051	.858	.502	.000	.000	.000	.449	.961	.000
Impedance 200k	.532	.065	.980	.490	.000	.000	.000	.519	.902	.000
Resistance 50k	.385	.028	.863	.356	.000	.000	.000	.312	.879	.000
Reactance 50k	.005	.000	.842	.000	.000	.005	.002	.001	.029	.000
Phase Angle 50k	.000	.000	.588	.000	.033	.573	.003	.002	.001	.000
Illness marker	.000	.268	.096	.284	.621	.354	.001	.259	.000	.000

Table 4.36 shows the result of Activity, Age and BMI groups of all categories. There is no significant difference in Activity group 1 and BMI group 3 except Reactance, Phase Angle at 50k and Illness marker. Have significant difference in Activity group 2 except Impedance at 5k, 100k and 200k, Illness marker too. None of significant difference here in Activity group 3. Age group 1 and BMI group 2 has also no significant difference .Age group 2 have significant difference except Illness marker and in age group 3 have also significant difference except Phase angle at 50k, Illness marker too. Finally the groups of BMI 1 and 4 have significant difference.

The table 4.37 below shows that the comparison of Bio Impedance Parameter of Leg 2 of female subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment aroma oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in female subjects. There is not enough data for comparing the results of BMI groups 1, 2 and 4.

Table.4. 37 Paired t-test result for the comparison of Activity, Age and BMI groups of leg2 female subjects before and after treatment using Aroma oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.000	.000	.001	.001	.000	-	.000	-	-
Impedance 50k	.000	.000	.001	.000	.000	.000	-	.000	-	-
Impedance 100k	.000	.000	.001	.000	.000	.000	-	.000	-	-
Impedance 200k	.000	.000	.003	.000	.000	.000	-	.000	-	-
Resistance 50k	.000	.000	.001	.000	.000	.000	-	.000	-	-
Reactance 50k	.000	.000	.000	.029	.029	.002	-	.000	-	-
Phase Angle 50k	.728	.000	.185	.892	.892	.000	-	.284	-	-
Illness marker	.024	.000	.016	.894	.894	.001	-	.003	-	-

Table 4.37 shows the result of Activity, Age and BMI groups of all categories. All variables have significant difference except Phase Angle at 50 k and it has significant difference in Activity group 2, Age group 3 and Illness marker in Age group 2.

The table 4.38 below shows that the comparison of Bio Impedance Parameter of Leg 2 of male subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in male subjects. There is not enough data for comparing the results of age group 2 and BMI group 4.

Table.4. 38 Paired t-test result for the comparison of Activity, Age and BMI groups of leg2 male subjects before and after treatment using Leech oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	.000	.000	.000	-	.000	.000	.000	.000	-
Impedance 50k	.000	.000	.000	.000	-	.000	.000	.000	.000	-
Impedance 100k	.000	.000	.048	.000	-	.000	.000	.000	.000	-
Impedance 200k	.000	.000	.000	.000	-	.000	.000	.000	.000	-
Resistance 50k	.000	.000	.120	.000	-	.000	.000	.000	.016	-
Reactance 50k	.000	.000	.000	.000	-	.000	.001	.000	.000	-
Phase Angle 50k	.000	.000	.754	.000	-	.000	.000	.000	.000	-
Illness marker	.000	.227	.000	.007	-	.000	.000	.071	.000	-

Table 4.38 shows the result of Activity, Age and BMI groups of all categories. All variables have significant difference except Phase Angle at 50 k in Activity group 3 and Illness marker in age group 2, BMI group 2 too. By comparing the results of leech oil with aroma cream, Leech oil has significant difference in leg2 male subjects.

The table 4.39 below shows that the comparison of Bio Impedance Parameter of Leg 2 of female subjects, Activity groups, age groups and BMI groups. Paired T test is used to analysis data. For conducting the experiments no oil was applied before and starting with the treatment Leech oil

applied in leg2. Paired T test shows the comparison of before and after treatment of aroma oil of leg2 in female subjects. There is not enough data for comparing the results of Activity group 2, 3; age group 2, 3 and BMI group 1, 3 and 4.

Table.4. 39 Paired t-test result for the comparison of Activity, Age and BMI groups of leg2 female subjects before and after treatment using Leech oil

Variables	Activity Group			Age Group			BMI Group			
	1	2	3	1	2	3	1	2	3	4
Impedance 5k	.000	-	-	.000	-	-	-	.000	-	-
Impedance 50k	.000	-	-	.000	-	-	-	.000	-	-
Impedance 100k	.000	-	-	.000	-	-	-	.000	-	-
Impedance 200k	.000	-	-	.000	-	-	-	.000	-	-
Resistance 50k	.001	-	-	.005	-	-	-	.031	-	-
Reactance 50k	.000	-	-	.000	-	-	-	.000	-	-
Phase Angle 50k	.000	-	-	.000	-	-	-	.000	-	-
Illness marker	.000	-	-	.000	-	-	-	.000	-	-

Table 4.39 shows the result of Activity, Age and BMI groups of all categories. All variables have significant. By comparing the results of leech oil with aroma cream, Leech oil has significant difference in leg2 female subjects.

CHAPTER 5: CONCLUSION AND RECOMMANDATION

5.1 Introduction

The statistical data shows significant results. Before and after measurements significantly difference in most of the analysis, so our hypothesis that Bio Impedance parameters significantly difference and bring about beneficial changes when comparing after with before aroma oil and leech in foot reflexology therapy.

5.2 Limitations

Some obstacles when conducting this study are recognized. It was hard to find the massage therapy center that gave the permission to get the subjects in their premise, due to high volume of patrons. Therefore some were done at the massage center when there were less customers at the center and for the remaining majority of subjects, the foot reflexology massage was done at home by the masseurs were it was done at massager house. In some cases the waiting time between completed massage and bio impedance readings was significantly large i.e. more than 15 minutes which may have affected our results. Also, most of the subjects were healthy, young males and were students, and this may not necessarily be representative of actual population in the real world. Some of the subjects didn't give full commitment during the experiment as it took a long duration (one hour or more). It was difficult to make sure the subjects are in a relaxation condition before experiment as they always make movement when the measurements are being taken. This problem leaves a doubt whether change in body composition is affected by massage therapy treatment or not. All those mentioned limitations have affected the study.

5.3 Recommendations

For future work, the author suggests that a broader variety of subjects should be recruited in terms of age, gender, occupation physical activity and health conditions to broaden the scope of the study. Also, the foot massage should be done in the proper settings, rather than at a crowded massage center with a pressure of time or a student house.

The findings of this study are:

1. Comparison between before and after foot reflexology aroma oil and leech oil therapy shows that this therapy can give a good effect of bio impedance and body composition parameters, and could be done more regularly for consistent better effects.

2. The following parameters were got after completing the measurements of subjects in this study:

a) Impedance 5k Increased

b) Impedance 50k Increased

c) Impedance 100k Increased

d) Impedance 200k Increased

e) Resistance (Ω) – Increased

f) Reactance (Ω) – Increased

g) Phase angle 50k (°) – Increased

h) Illness Marker Decreased

3. This subject should be researched more, with other subjects and different oils to give solid recommendations of this therapy to others as a therapeutic activity.

5.4 Conclusion

The study concluded that bioimpedance (BI) parameters of subjects before and after foot reflexology therapy using aroma oil and leech oil are significantly different. It showed that all the parameters gave a sign of improvement in the body health. Therefore foot reflexology massage therapy is proven in making a good state of health as most of the parameters have shown an increase in cellular health after the experiment. This kind of this study is useful for professional massage therapists in order to explain the beneficial effects of foot reflexology therapy. The BIA technique is one of the safest techniques, simple, quick and noninvasive without any side effects. BIA technique shows that the body composition can be assessed safely and accurately when study about human body composition. The comparison of Aroma and leech oil, the leech oil is significant difference rather than Aroma oil.

APENDICES

Table A1 shows the Post Hoc Tests result of leg1 using Aroma oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.014	.121	.015	.436	.034	.012	.141	.003
	V.Low/Medium	.002	.011	.194	.006	.051	.001	.075	.000
	Low Medium/Medium	.464	.319	1.000	.055	.891	.559	999	.149
Age	21-30/30-40	.004	.000	.000	.000	.002	.000	.000	.313
	21-30/41-50	1.000	.945	.789	.943	.886	.178	.000	.000
	31-40/41-50	.708	.419	.006	.005	.379	.000	.000	.000
BMI	Underweight/ Normal Weight	.003	.019	.018	.079	.013	.001	.769	.997
	Underweight/ Over Weight	.000	.000	.000	.003	.000	.000	.932	.990

	Underweight/ Obesity	-	-	-	-	-	-	-	-
	Normal Weight/Over weight	.000	.000	.000	010	.000	.000	.75	.524
	Normal weight/Obesity	-	-	-	-	-	-	-	-
	Over weight/Obesity	-	-	-	-	-	-	-	-

Table A 2 shows the Post Hoc Tests result of leg2 using Aroma oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.570	.031	.027	.018	.033	.361	.368	.523
	V.Low/Medium	.177	.464	.520	.481	.487	.043	.133	.157
	Low Medium/Medium	.962	.421	.342	.286	.413	.591	.024	.473
Age	21-30/30-40	.800	.784	.741	.737	.771	.364	.020	.712
	21-30/41-50	.118	.163	.348	.469	.194	.000	.002	.738
	31-40/41-50	.305	.354	.398	.432	.362	.020	.585	.961
BMI	Underweight/ Normal Weight	.341	.015	.045	.072	.017	.000	.000	.874

	Underweight/ Over Weight	.029	.000	.000	.000	.000	.000	.000	.000
	Underweight/ Obesity	.000	.000	.003	.000	.000	.000	.000	.000
	Normal Weight/Over weight	.038	.000	.000	.000	.000	.013	.663	.751
	Normal weight/Obesity	.999	.299	.191	.447	.312	.281	.000	.743
	Over weight/Obesity	.000	.000	.000	.000	.000	.000	.032	.998

Table A3 shows the Post Hoc Tests result of leg1 male subject using Aroma oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.334	.646	.710	.749	.657	.061	.363	.148
	V.Low/Medium	.053	.102	.847	.026	.438	.005	.275	.002
	Low Medium/Medium	.464	.319	1.000	.055	.891	.559	.999	.149
Age	21-30/30-40	.346	.000	.000	.000	.000	.000	.009	.011
	21-30/41-50	.999	.970	.943	.935	.967	.343	.000	.000
	31-40/41-50	965	.864	.057	.128	.536	.014	.000	.000
BMI	Underweight/ Normal Weight	.021	.049	.084	.116	.052	.086	.590	.862
	Underweight/ Over Weight	.000	.000	.000	.007	.000	.000	.991	.999
	Underweight/ Obesity	-	-	-	-	-	-	-	-

	Normal Weight/Over weight	.000	.001	.000	.041	.000	.000	.133	.123
	Normal weight/Obesity	-	-	-	-	-	-	-	-
	Over weight/Obesity	-	-	-	-	-	-	-	-

Table A4 shows the Post Hoc Tests result of leg2 male subject using Aroma oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.140	.726	.762	.821	.720	.195	.163	.516
	V.Low/Medium	.692	.550	.553	.564	.545	.993	.751	.772
	Low Medium/Medium	.481	.975	.951	.951	.974	.501	.075	.494
Age	21-30/30-40	.895	.053	.037	.022	.059	.653	.443	.533
	21-30/41-50	.852	1.000	.730	.379	.999	.000	.000	.827
	31-40/41-50	.535	.000	.000	.000	.000	.000	.000	.000
BMI	Underweight/ Normal Weight	.114	.000	.000	.000	.000	.000	.000	.861
	Underweight/ Over Weight	.029	.000	.000	.000	.000	.000	.000	.000
	Underweight/ Obesity	.000	.000	.003	.000	.000	.000	.000	.000
	Normal Weight/Overweight	.016	.000	.000	.000	.000	.000	1.000	.784

	Normal weight/Obesity	.979	.001	.001	.002	.001	.895	.017	.779
	Over weight/Obesity	.000	.000	.000	.000	.000	.000	.032	.998

Table A5 shows the Post Hoc Tests result of leg1 using Leech oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.022	.280	.001	.000	.002	.857	.095	.989
	V.Low/Medium	.091	.630	.018	.021	.006	.008	.511	.710
	Low Medium/Medium	.755	.006	.848	.552	.996	.076	.24	.760
Age	21-30/30-40	.948	.994	1.000	1.000	.996	.009	.152	.407
	21-30/41-50	.019	.000	.001	.002	.000	.000	.002	.410
	31-40/41-50	.112	.189	.242	.239	.198	.022	.821	.999
BMI	Underweight/ Normal Weight	.009	.000	.000	.000	.000	.000	.000	.929
	Underweight/ Over Weight	1.000	.958	1.000	.712	.995	.000	.000	.907
	Underweight/ Obesity	.000	.000	.000	.000	.000	.000	.000	.000
	Normal Weight/Over weight	.000	.000	.000	.000	.000	.735	.227	1.000

	Normal weight/Obesity	1.000	1.000	1.000	1.000	1.000	.053	.002	.906
	Over weight/Obesity	.000	.000	.000	.000	.000	.924	.001	.891

Table A6 shows the Post Hoc Tests result of leg2 using Leech oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.005	.011	.001	.093	.002	.001	.012	.986
	V.Low/Medium	.883	.389	.774	.357	1.000	.006	.001	.754
	Low Medium/Medium	.541	.845	.002	.980	.033	.977	.340	.746
Age	21-30/30-40	.002	.000	.000	.000	.003	.000	.007	.678
	21-30/41-50	.997	1.000	.913	.997	.988	.010	.000	.815
	31-40/41-50	.354	.075	.002	.000	.439	.000	.000	.010
BMI	Underweight/ Normal Weight	.064	.501	.110	.701	.195	.960	.875	.674
	Underweight/ Over Weight	.000	.001	.000	.006	.000	.017	.944	.780

	Underweight/ Obesity	-	-	-	-	-	-	-	-
	Normal Weight/Over weight	.001	.000	.000	.001	.000	.002	.942	.609
	Normal weight/Obesity	-	-	-	-	-	-	-	-
	Over weight/Obesity	-	-	-	-	-	-	-	-

Table A7 shows the Post Hoc Tests result of leg1 male subjects using Leech oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.492	.993	.999	.986	.993	.334	.300	.893
	V.Low/Medium	.822	1.000	.980	.968	1.000	.627	.608	.677
	Low Medium/Medium	.846	.987	.995	.879	.991	.136	.098	.763
Age	21-30/30-40	.393	.000	.000	.000	.000	.931	.000	.321
	21-30/41-50	.042	.000	.000	.000	.000	.000	.000	.432
	31-40/41-50	.000	.704	.000	.000	.097	.000	.000	.000
BMI	Underweight/ Normal Weight	.005	.000	.000	.000	.000	.000	.000	.914
	Underweight/ Over Weight	1.000	.958	1.000	.712	.995	.000	.000	.907
	Underweight/ Obesity	.000	.000	.000	.000	.000	.000	.000	.000
	Normal Weight/Overweight	.009	.000	.000	.000	.000	.010	.423	1.000

	Normal weight/Obesity	.410	.001	.002	.003	.002	.000	.003	.898
	Over weight/Obesity	.000	.000	.000	.000	.000	.924	.001	.891

Table A8 shows the Post Hoc Tests result of leg2 male subjects using Leech oil for the comparison of Bio Impedance Parameters between different Categories of groups of Activity, Age and BMI

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Activity	V.Low/Low Medium	.073	.078	.101	.167	.084	.002	.047	.985
	V.Low/Medium	.986	.627	.264	.396	.898	.008	.003	.755
	Low Medium/Medium	.541	.845	.002	.980	.033	.997	.340	.746
Age	21-30/30-40	.088	.000	.000	.000	.000	.000	.184	.700
	21-30/41-50	.937	.981	1.000	.997	.997	.002	.000	.860
	31-40/41-50	.593	.311	.054	.017	.778	.000	.000	.002
	Underweight/ Normal Weight	.259	.768	.720	.804	.495	.720	.748	.684
	Underweight/ Over Weight	.000	.004	.107	.022	.001	.107	.923	.719
	Underweight/ Obesity	-	-	-	-	-	-	-	-

BMI	Normal Weight/Over weight	.016	.001	.014	.023	.000	.014	.787	.633
	Normal weight/Obesity	-	-	-	-	-	-	-	-
	Over weight/Obesity	-	-	-	-	-	-	-	-

Table A9 shows the Post Hoc Tests result of leg2 female subjects using Leech oil for the comparison of Bio Impedance Parameters between different Categories of Age Group

Analyzed Groups	Comparison pair	Impedance 5k	Impedance 50k	Impedance 100k	Impedance 200k	Resistance 50k	Reactance 50k	Phase Angle 50k	illness marker
Age	21-30/30-40	.033	.016	.014	.010	.015	.802	.001	.001
	21-30/41-50	.125	.015	.006	.000	.009	.945	.051	.111
	31-40/41-50	.169	.118	.115	.099	.118	.403	.018	.004

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