A Comparative Study on the Effectiveness of Application Techniques of Tissue Oil Enriched with Rooibos (*Aspalathus Linearis*) Extract on Dehydrated Skin of Women Aged Between 18 and 45 Years.

Submitted in fulfillment of the requirements
of the Degree of Master of Technology: Somatology
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by

Raihaana Van der Schyff

A dissertation submitted to the Faculty of Health Sciences at The Durban University of Technology in partial compliance with the requirements for a Master's Degree in Technology: Somatology.

I, Raihaana Van der Schyff, do declare that this dissertation is representative of my own work in both conception and execution.

Signature of student: _____ Date: _____

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ABSTRACT

Human skin is the largest organ in the body and constitutes the first line of defense as it offers protection to the underlying structures such as the muscles, bones, ligaments and internal organs. Daily, the skin comes into contact with the environment and plays an important role in protecting the body against excessive water loss and dangerous pathogens. Due to these factors, the skin can develop conditions such as dehydration, sensitivity, sagging or dryness. Thus, women are constantly seeking effective and speedy treatments to increase the hydration levels and improve the appearance of their skins.

This study aimed to compare the effectiveness of two different application techniques, (hot oil mask and Swedish massage), using Rooibos-enriched tissue oil on dehydrated skin of women to assist in establishing which application method was the most effective. The findings of this comparative study will provide Somatologists with the knowledge of the quickest and most effective treatment techniques when using this tissue oil to treat dehydrated skin for women between the ages of 18 and 45 years.

An experimental design, using a pre-test and post-test method to compare participant groups was administered. Purposive sampling was used as only females between the ages of 18-45 years of age who were clinically diagnosed by a dermatologist with evidence of existing dehydration and measured on the Fitzpatrick scale between 3–5, were included in the study. The sample size comprised of sixty-two (n=62) participants. Participants (students and staff) were recruited from the Cape University of Technology in the Cape Province, South Africa. The Bt-Analyze^{TM} skin identification and the Multi-skin test Centre 750® were used to perform the skin evaluations.

The findings suggest that both the Swedish massage (p=0.000 to 0.003 across the different age groups) and the hot oil mask applications (p=0.000 to 0.004 across the different age groups) reflected a significant improvement in the hydration levels of the skin after just three applications (30%). Observations of clinical photographs suggested that the Swedish massage applications were visibly more effective for the age group 18-23 years(p=0.000) and 36-41(p=0.002), compared to the hot oil mask applications which appeared visibly more effective for the age groups 30-35(p=0.001) and 42-45(p=0.000). However, the TEWL values were statistically significant (p<0.05)

for all age groups except for the age group 30-35 (p<0.363), 36-41 (p<0.952) and 42-45 (p<0.544).

Upon completion of the study, all participants showed an improvement in hydration levels within the physiological parameters of the skin. The skin appeared visibly less dry with fewer fine lines. Participants who had previously reported experiencing flaky or taut skin, were more comfortable and satisfied with the texture of their skin post treatment as it felt smoother. In general, the tissue oil with rooibos extract had a positive hydrating effect on the skin irrespective of the application method although age did have an influence. Most of the improvements occurred after the first application of the product.

Factors such as age, product usage, water consumption and exercise do influence the skin hydration levels. Therefore, these factors should be considered as future recommendations when designing treatment programmes for improving skin hydration levels. Finally, massage oil application methods should be incorporated into treatments designed for the younger age groups (under 40 years) and the hot oil mask is recommended for mature skin (over 40 years) to achieve the best results.

DEDICATION

I dedicate this dissertation to my family

Sedick (Father), Morida (Mother), sisters: Malikah and Aneesah Van der Schyff. Thank you for the encouragement and for believing in me. I could not have done this without you. Your continuous love, support and sacrifices not only for my dissertation but also for my entire academic career have not gone unnoticed. I cannot begin to explain how much I appreciate you.

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African Extracts for making my products readily available for my study

To all my research participants: without you this study would not have been possible. Thank you for taking the time out of your schedule to participate.

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List of Acronyms

a.u.	Arbitrary Units
CTFA	Cosmetic Toiletry and Fragrance Association
DNA	Deoxyribonucleic Acid
FDA	Food and Drug Administration
LDL	Low-density lipoprotein
NMF	Natural Moisturising Factors
O/W	Oil in water emulsion
PUFA	Polyunsaturated Fatty Acid
RH	Relative Humidity
ROS	Reactive Oxygen Species
SC	Stratum Corneum
SL	Stratum Lucidum
TEWL	Trans-epidermal Waterloss
W/O	Water in oil emulsion

CHAPTER ONE: INTRODUCTION

1.1 BACKGROUND OF THE STUDY

Medical professionals have recognised the benefit of incorporating non-invasive aesthetic services into their practices as they provide rewarding business exhilaration (Nkwanyana 2015:22). Nkwanyana (2015:22) further indicated that, over the past decade, medical professionals had become aware of services that aestheticians/somatologists offer as adjunctive interventions to improve clinical outcomes for client satisfaction. Therefore, there is an increase of aestheticians/somatologists in medical practices internationally.

Globally, the interest in the development of natural herbal ingredient-based topically applied cosmetic products has increased in recent years. As a consequent, a higher market demand for preservative-free products based on herbal ingredients has resulted (Cizauskaite & Bernatoniene 2018:1) According to Kahn (2013:1) South Africa's aesthetic medicine market has been driven by an increasing demand for "subtler, more natural" techniques for treating skin conditions and disorders. The rapid development of the beauty industry has influenced people to seek quick and efficient methods to treat their skin concerns. Due to the beauty industry moving at a rapid pace, people are looking for the quickest but most efficient way to treat their skin concerns.

Somatologists are trained in using different techniques and applications to efficiently recognise different skin types, conditions and disorders. After identifying the condition, clients are referred to the most appropriate product house or medical practitioner to improve the prognosis.

The integumentary system comprising of the skin is considered the largest organ in the body, covering a surface area of approximately two meters (McLafferty *et al.* 2013:35). The skin constitutes the first line of resistance as well as protects the underlying muscles, bones, ligaments and internal organs (Hamdani *&* Tabassum

2014:52). Every day the skin interfaces with the external environment and plays a vital role in protecting the body against pathogens and excessive water loss, which can cause skin conditions such as dehydration, sensitivity, sallowness, sagging or dryness (Hamdani *et al.* 2014:53).

Nedic (2014:26) stated that most women have skin and body concerns. While some women make their peace with it, a vast majority wage against it. Feeling self-confident about one's appearance through the use of cosmetics, may be principally valued in expediting social interactions, especially in first appearances (Nash *et al.* 2006:1)

Therefore, there are numerous products and treatments on the market to address their insecurities. Nedic (2014:27) asserts that most women prefer non-invasive procedures as there is less pain, less scarring, a quicker recovery as well as reduced health care costs.

African Extract™ Rooibos (2014:1) claimed the most effective, gentle skin-care ingredients were found from various habitats of the world and sourced from plants. The science of modern skin care confirmed which generations of indigenous people knew about the benefits of plant materials (Magcwebeba *et al.* 2016:2 & African Extract™ Rooibos 2014:1).

This study compared the application techniques of the tissue oil which resulted in the enhancement of skin hydration within a timeframe. These results provide the Somatology profession with the knowledge of how to increase the effectiveness of their treatments to improve hydration levels of the epidermal layer of the skin.

1.2 PROBLEM STATEMENT

It has been established that tissue oil is found as an active ingredient in many products produced for skin and nails (Hobson 2016:331). According to Irons *et al.* (2014:1), tissue oil is a strong antioxidant which should be incorporated into a daily diet. Tissue oil is available either in liquid or capsule form, used on its own or mixed with other oils to enhance its effects for topical application.

Tissue oil, which is naturally high in Vitamin E, has been used by several different companies for many years because of its known protecting antioxidant properties (Tiedtke 2002:16). Sarullo (2014:8) reported that tissue oil aids in skin hydration and

is advised for use on scars, stretch marks and a variety of other skin conditions. African Extracts™ has developed a tissue oil product that has been enriched with a rooibos tea concentrate to enhance its antioxidant properties. During cellular ageing the body become less capable of fighting off free radicals resulting in degenerative changes within the skin. Botha and Engelbrecht (2007:2) reported that tissue oil improved the appearance of scarred skin, the appearance of dry, dehydrated skin that was damaged by various elements, sensitive skin, and skin under stress in pregnancy or at times of weight gain or loss. Additionally, there was evidence of improved nourishment on dry, brittle and damaged nails and cuticles, and improved dull, lifeless hair and scalp (Botha & Engelbrecht 2007:2).

While the establishment of the concentrations of the active ingredients in the tissue oil, the assessment of its stability and its shelf-life has been confirmed by Botha and Engelbrecht (2007:2), the oil's effectiveness through different methods of application has not yet been established. The findings of this study will inform the rapidly evolving Somatology industry of the most effective treatment application methods to increase hydration levels of the epidermal layer of the skin within the shortest time.

1.3 AIM AND RESEARCH OBJECTIVES

1.3.1 Aim

This study aimed to compare the effectiveness of two different application techniques, hot oil mask and Swedish massage, using Rooibos-enriched tissue oil on dehydrated skin in women of different ages, to establish which application method is more effective. The findings of this comparative study will provide somatologists with the knowledge of the quickest and most effective treatment techniques.

1.3.2 Research Objectives

1. To determine whether the hydration levels of the skin are influenced by the application of a hot oil mask application of the Rooibos enriched tissue oil measured using theBt – Analyze™ skin identification and Multi skin test centre 750®.

2. To determine whether the hydration levels of the skin are influenced by the application of a 20-minute massage application of the Rooibos enriched tissue oil measured using theBt – Analyze™ skin identification and Multi skin test centre 750®.

3. To establish which method of application of the Rooibos enriched tissue oil, hot oil mask or the 20-minute Swedish massage, is more effective in improving hydration levels of the skin as measured by the Multi skin centre 750®.

1.4 LAYOUT OF DISSERTATION

Chapter One will provide an overview of this research and will include the rationale for the study, aims and objectives, as well as the scope of the study. Chapter Two includes the literature review related to tissue oil enriched with Rooibos extract.

In Chapter Three, the methodology, research approaches, sampling strategies and data analytical methods as well as the population and sample size are discussed. In Chapter Four the findings, the results and data analysis are presented. Chapter Five presents the conclusions and discussion of the findings. Finally, Chapter Six presents the recommendations for a future study.

CHAPTER TWO: LITERATURE REVIEW

2.1 INTRODUCTION

The utilisation of medicinal plants and their preparations have been used for centuries to preserve and boost human beauty (Narayanaswamy & Balakrishnan 2011:381). Studies today are shifting towards herbal natural cosmetics due to the harmful effects of chemicals Ahshawat *et al*. (2008:183) and selecting as Saraf *et al.* (2010:2) refers to as poly-herbal cosmetic formulations instead for the management of many skin conditions.

According to Raimondo (2011:1) and Kishore (2014:61), South Africa is paramount for botanical diversity, several plant species was used since prehistoric times in ethnomedicine, however, only a limited amount of species have been scientifically investigated. A large quantity of the South African population uses traditional medicine for their physical and psychological health needs (Kishore 2014:61). Rooibos has been rarely used outside of South Africa as a cosmetic raw material, but its use is expanding within the skincare industry (Tiedtke 2002:17, Mahomoodally 2015:2 & Sishi 2018:2). Sishi (2018:12), reports that topical applications of Rooibos were added to cosmetic products since it treated common dermatological problems such as eczema. Vink *et al.* (2014:44) also states that Rooibos has many uses, especially within the health industry as it is used as a key ingredient in skincare products. In a research study conducted by Gadow *et al.* (1997:42) cited in Tiedtke (2002:16) and Herbst (2015:3) it was reported that Rooibos tea is caffeine free and possesses strong antioxidant properties, anti-inflammatory and antimicrobial characteristics which consumers are becoming more aware of.

2.2 OVERVIEW OF THE SKIN

As early as the Egyptian and Babylonian eras, topical applications were used as a route of medicinal delivery through ointments, salves and pomades (Huang 2006: 57 & Draelos 2015:91). Administration through the skin is categorized into two approaches: (1) topical delivery, for local therapeutic effects, for example skin conditions and skin diseases; and (2) transdermal delivery, for local therapeutic or medicinal effects. In either case, molecules are taken up by the skin (Huang 2006:58). The term skin uptake is commonly used to describe the molecules upon their entry into the skin.

Product delivery via the skin has several advantages over conventional routes (Huang 2006:58). It avoids metabolism by the liver and enzymatic degradation in the gastrointestinal tract. It is a non-invasive method of application with no trauma or risk of infection and may improve participant compliance because of its user-friendliness.

2.3 STRUCTURE OF THE SKIN

The skin is the largest organ of the body at approximately 20 square feet (Saraf *et al*. 2010:1) and plays a vital role in keeping the body together Teixeira (2006:6). It is responsible for several functions, such as; regulating body temperature, protection, providing sensation, excreting waste products, immunity and synthesizing Vitamin D (Teixeira 2006:6 & Venus *et al.* 2010:469).

The skin is composed of a stratified outer cellular layer (the epidermis) and an underlying layer composed of connective tissue (the dermis) (Saraf *et al*. 2010:1). In addition, Van der Westhuizen (2013:10) reports that the epidermal and dermal layers, and is semi-porous, thus allowing substances to enter the body via the skin route. Certain locations on the skin of the human body are more porous and permeable than other areas such as the forearms, palms, forehead, soles and scalp. There was a decreased absorption rate which occurred in areas that are semi-porous such as the upper body, abdominal area and the legs. Due to the minute molecular size of the essential carrier oil, it allows the molecules to filter through the skin easily (Van der Westhuizen 2013:10). Although Rooibos extract is not classified as an essential oil but can be used in conjunction with a carrier oil or other essential oil to help transport its benefits to the skin.

According to Van der Westhuizen (2013:11), two routes for essential oil absorption on the skin exist, namely, the follicles of the hair and the epidermal pore openings. The most important factor for dermal absorption lies in the coupling between the skin's sebum, produced by the sebaceous gland, and the size of the oil molecules (Van der Westhuizen 2013:11). Zsiko *et al.* (2019:3) also describes two principal absorption pathways into the skin as depicted in the diagram below:

Two major thorough fares exist for essential oils to penetrate the skin:

1. Through the stratum corneum directly or
2. Via shunts (the hair follicles and sweat gland ducts)

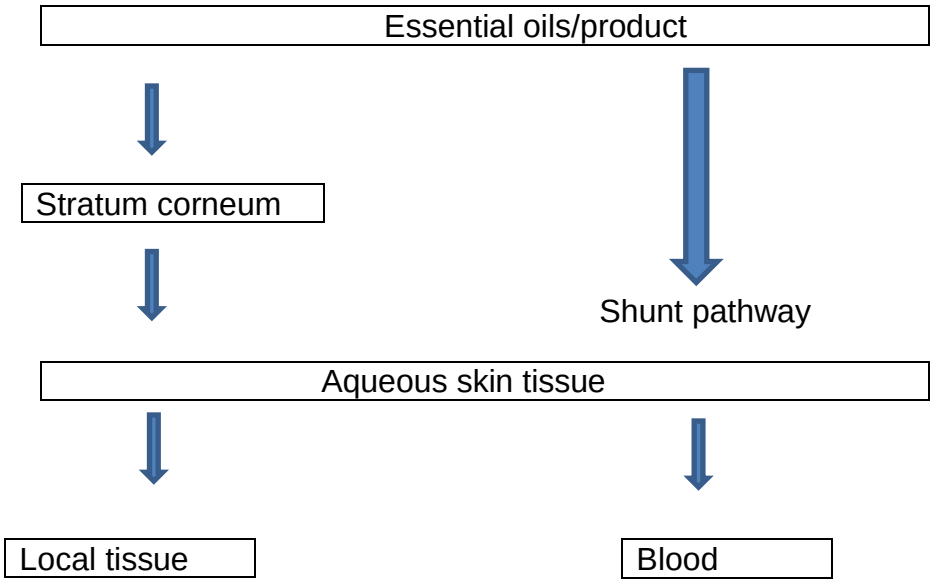


Figure 2.3 A Schematic diagram showing the principal absorption pathways into the skin (Zsiko *et al.* 2019:3).

While Zsiko *et al.* (2019:3) is addressing the penetration of oils topically applied to the skin, Bagajewicz *et al.* (2011:4) reports that there are three percutaneous transport pathways through the stratum corneum (Figure 23B). Pathway 1 involves the intercellular diffusion though the lipid lamellae. The second, is transcellular diffusion though both the keratinized proteins as well as the lipid lamellae. The third pathway involves the diffusion through the appendages (hair follicles and sweat ducts) of the skin. However, due to the compactness of the intracellular matrix, the second pathway does not favour transcellular absorption of chemical transport.

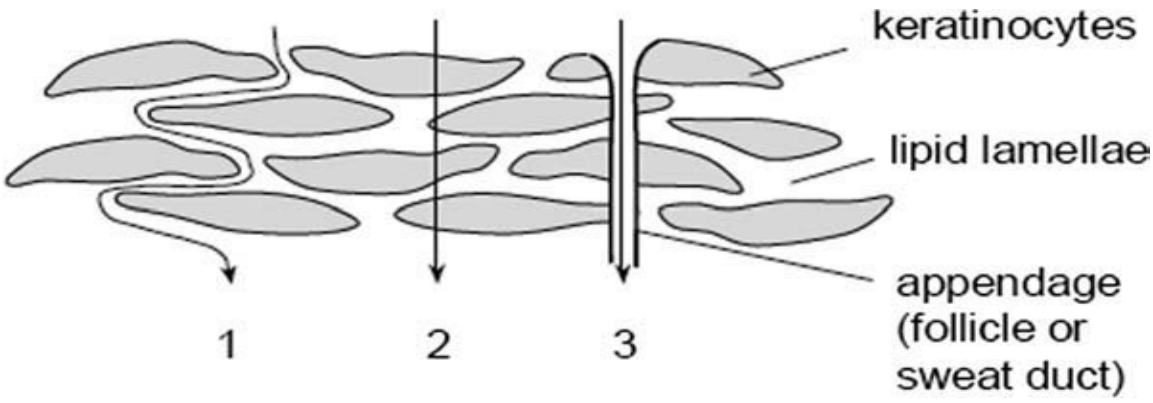


Figure: 2.3 B: illustration of the transdermal transport pathways Bagajewicz *et al*. (2011:4)

The structure of the skin is composed of two key components, an external thinner portion referred to as the epidermis (which further consists of five layers), and an internal thicker portion referred to as the dermis (which is divided into the reticular and papillary layer) (Cheong & McGrath 2013:317). Under the dermis is the subcutaneous layer also known as the hypodermis which attaches the skin to the underlying structures (Teixeira, 2006:7).

2.3.1 Epidermis

The outermost layer of the skin is called the epidermis and is composed mostly of stratified layers of flattened cells, which covers the basal layer (stratum basale) composed of columnar cells (McGrath *et al*. 2004:1). According to McGrath *et al.* 2004:1) the epidermis is the outer (*epi* in Greek meaning "over" or "upon") regulates the quantity of water evaporated from the body into the atmosphere through trans-epidermal water loss (TEWL) and provides a barrier from environmental pathogens.

Teixeira (2006:7) and Baroni *et al.* (2012:257) explained that the epidermis is made up of five different layers which consists mostly of keratinised stratified squamous epithelium i.e.; stratum corneum, stratum lucidum, stratum granulosum, stratum spinosum and stratum basale. The deepest part of the epidermis is where new cells

are produced, develop, die and eventually sloughed off as they reach the Stratum Corneum (Teixeira 2006:7 & Venus *et al.* 2010:469).

2.3.1.1 The Stratum Corneum

The stratum corneum, known as the outermost layer of the epidermis is mostly composed of keratinized cells also known as corneocytes; which are immersed in a lipid matrix made up of ceramides, cholesterol, and fatty acids (McGrath *et al.* 2004:1). This layer is constructed of up to 20 layers of flattened cells with no nuclei therefore, there is no basis for activity or growth (McGrath *et al.* 2004: 1; Venus *et al.* 2010:469 & Baroni *et al.* 2012:257*)*.

McGrath *et al.* (2004:1) and Logtestijn *et al.* (2015:2) explains the main purpose of the stratum corneum (SC) is to act as a barrier of protection for the underlying tissues from various harmful external factors. The other role is to act as 'spacers' which control and force water, microbes, and xenobiotics through the extracellular lipid-enriched pathway Bagajewicz *et al.* (2011:3). Exfoliation of the skin on a regular basis aids in balancing proliferating keratinocytes that form within the stratum basale, desquamation is known as the process of keratinized skin cells shedding from the surface of the stratum corneum, these keratinocytes travel through the epidermis towards the surface in a time period of approximately fourteen days (McGrath *et al.* 2004:1; Roger *et al.* 2019:439 & Saraf *et al*. 2010:1). Located in the stratum corneum is the skin's natural moisturising factors (NMF) which are responsible for both the absorption and retention of water (Bagajewicz *et al*. 2011:3).

Keratinocytes are modified into lifeless corneocytes whereby the cell membrane is replaced by a layer of ceramides, which become linked to form a cornified envelope that contributes to the skin's barrier function (McGrath *et al*. 2004:1 & Rosso *et al.* 2011:23). Maintenance of skin homeostasis is dependent on the desquamation and formation of the cornified envelope, if these processes are not regulated this would lead to the onset of skin conditions and disorders (McGrath *et al.* 2004:1 & Rosso *et al.* 2011:23). Cells of the stratum corneum contains a protein made of a dense network of keratin which assists with water absorption, further aiding in hydration (Matsui & Amagai 2015:271). McGrath *et al.* (2004:1) and Oltulu *et al.* (2018:58) states the thickness of the stratum corneum varies throughout the body, it is stabilized and built by the underlying layer called the stratum lucidum (SL) which allows the cells to

concentrate keratin, strengthen and toughen them before they escalate into a thicker, more cohesive stratum corneum.

2.3.1.2 The Stratum Lucidum

McGrath *et al.* (2004:1), Yousef and Sharma (2017:2) defines the stratum lucidum (Latin for "clear layer") as a thin, clear layer in the epidermis, therefore commonly known for its translucent structural appearance under a light microscope. It is commonly found in areas of thick skin, which are found mostly on the palms of the hands and the soles of the feet of the body (McGrath *et al*. 2004:1 & Yousef and Sharma 2017:2). Mc Grath *et al.* (2004:1) explains it consists of upto to five layers of, eleidin; a healthy form of compressed keratinocytes which all are similar in structure. According to Jacuszeit (2015:11), mitosis (division) of the epidermal cells controls the thickness of the lucidum, in addition, melanosomes which are found in abundance within this layer determines the darkness of the stratum lucidum (Jacuszeit 2015:11).

2.3.1.3 The Stratum Granulosum

McGrath *et al.* (2004:2) and Edqvist *et al.* (2015:136) describes the stratum granulosum (or granular layer) as a thin layer of cells in the epidermis, these cells mostly consist of keratohyalin granules, which contain histidine- and cysteine- (rich proteins), primarily its function is to bind the keratin filaments together for cellular cohesion. McGrath *et al.* (2004:2) mentions the hydrophobic lipid envelope is accountable for the skin's hydration barrier properties thus, the cells lose their nuclei and organelles causing the granular cells to become inoperable corneocytes in the stratum corneum allowing for desquamation to occur (McGrath *et al*. 2004:2 & Edqvist *et al.* 2015:136).

2.3.1.4 The Stratum Spinosum

McGrath *et al.* (2004:2) and Edqvist *et al.* (2015:136) positions this spinous or prickle cell layer between the stratum granulosum and stratum basale. The appearance is developed by the shrinking of the microfilaments between desmosomes, it is also known for the onset of keratinization McGrath *et al.* (2004:2). The structure of this layer mainly consists of a large pale-staining nuclei as they are responsible for

synthesizing fibrillar proteins, known as cytokeratin, which build up within the cells allowing it to accumulate together forming tonofibrils (Edqvist *et al.* 2015:136). The tonofibrils form the desmosomes, which allow for solid connections to form between adjacent keratinocytes because of their cytoplasmic protein structures (McGrath *et al*. 2004:2).

2.3.1.5 The Stratum Basale/ Germinativum

The stratum basale is sometimes identified as the stratum germinativum it is the deepest of the five layers of the epidermis (McGrath *et al*. 2004:2 & Yousef and Sharma 2017:2). The stratum basale is described as a thin continuous layer of cells which is only one cell thick (McGrath *et al*. 2004:2). The stratum basale primarily consists of basal keratinocyte stem cells which divide to form the keratinocytes of the stratum spinosum as they travel superficially towards the stratum corneum (McGrath *et al.* 2004:2 & Adams *et al.* 2015:2). There are other cells found within the stratum basale with important functions such as the keratinocytes (dead skin cells), melanocytes (pigment-producing cells), Langerhans cells (immune cells), and Merkel cells (touch receptors) (McGrath *et al.* 2004:2 & Adams *et al.* 2015:2).

2.3.2 Dermis and Subcutaneous Layer

Kanitakis (2002:395) and McLafferty *et al.* (2013:35) describes the dermis as a vital supportive structure and consists mostly of elastic connective tissue which serves to protect the appendages of the skin, vascular and nerve plexuses running through it. Kanitakis (2002: 395) explains the cellular turnover of cells are regulated by mechanisms which control the synthesis and degradation of its protein components. The depth of the dermis varies substantially with location being much thicker on certain areas than others, its fine structure varies from the thin papillary dermis to the thicker reticular or deep dermis (Kanitakis 2002:395 & Yousef and Sharma 2017:2).

Kanitakis (2002:396) and Driskell *et al.* (2015:631) notes that the subcutaneous layer or hypodermis represents the deepest part of the skin, which primarily consists of adipose (fatty tissue), separating it from the underlying aponeuroses or the periosteum of the bones or connective tissue (Kanitakis 2002:396 & Driskell *et al.* 2015:631).

Furthermore, its functions vary and therefore plays a vital role in thermoregulation, insulation, provision of energy and protection from mechanical injuries.

2.4 SKIN CONDITION (DEHYDRATION)

Dehydration, being one of the common skin conditions, has been an ongoing prognosis in many clients (Liu *et al.* 2015:1 & Van Erp *et al.* 2018:867). Some of the causes of dehydration are due to the amount of water consumption, exposure to the environment, incorrect product usage (harsh soaps or irritants) and the storage capacity of the Stratum corneum (Saraf *et al*. 2010:2, Liu *et al.* 2015:1 & Van Erp *et al.* 2018:867). The barrier membrane in the skin has an important role to limit water evaporation from the body, and to prevent the entry of exogenous chemicals (Sparr *et al*. (2014:1). Kanitakis (2002:390), Fox *et al.* (2011:10508) and Boer *et al.* (2016:1) describes the basic structures that make up the skin as follows: ”the outer part of the skin, the epidermis, consists of different layers which are partly oil-loving (lipophilic) and partly water-loving (hydrophilic) which explains why many individual ingredients struggle to get past this barrier because they are generally one or the other and not both at the same time”.

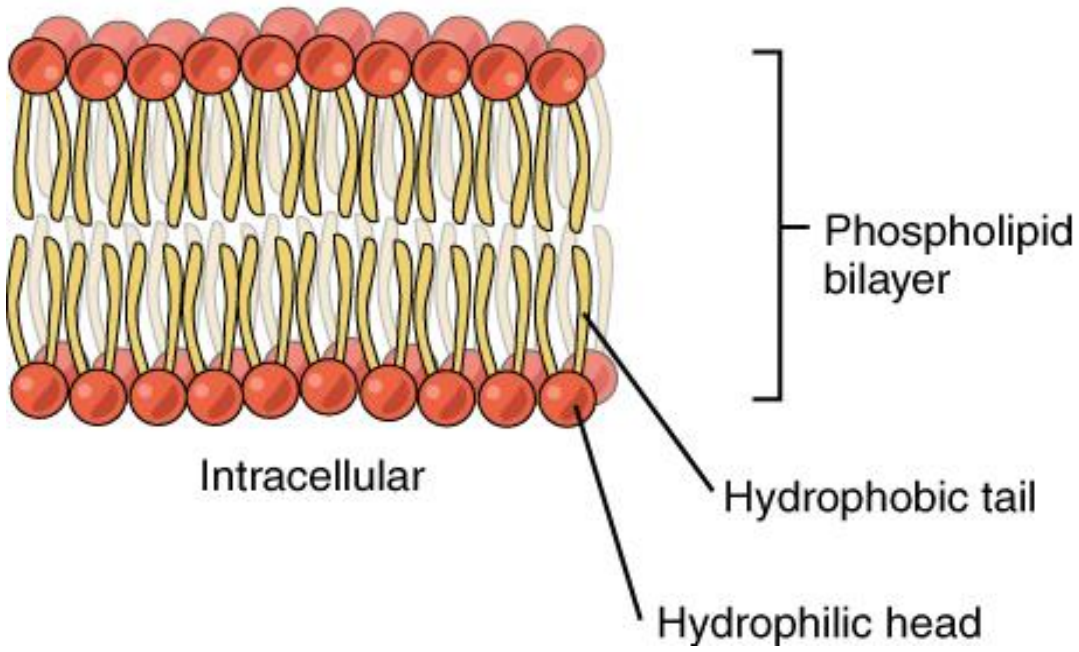


Figure 2.4 A. Structure of the bi-layers within the epidermis (McCarthy 2006).

In a healthy stratum corneum the water content is approximately 30% but is dependent on the rate at which water arrives from the tissues beneath including how fast it leaves the skin surface through evaporation. This is also dependent on its ability to retain water (Bagajewicz *et al.* 2011:4). Trans-epidermal water loss (TEWL) refers to the tiny amount of water that journeys through the stratum corneum which hydrates the outer layers of the epidermis. This maintains its flexibility and delivers sufficient water to allow enzyme reactions to facilitate the stratum corneum maturation happenings, coupled with corneodesmolysis and finally desquamation (Rawlings 2006:1).

However, Sparr *et al.* (2014:1) stated, through a healthy skin about 100–150 ml of the TEWL is evaporated per day. Furthermore, the impelling force for the TEWL is the difference in water activity between the tissue which is abundant in water inside the body compared to the dehydrated environment outside the body (characterized by the relative humidity (RH)) in the air (Sparr *et al*. 2014:1).

Sparr *et al*. (2014:1) and Natsuga (2014:1) explains that a healthy skin is scarce as there are constantly unusual membrane permeability changes with water activity (or RH) outside the body.

The hydration of the stratum corneum membrane has an important role in managing the barrier properties as it is an essential factor to other vital functions such as the mechanical properties, appearance and the enzymatic activity within the stratum corneum (Sparr *et al.* 2014:1; Natsuga 2014:2 & Segre 2006:1155). Under normal conditions, they further explain, the water capacity for skin hydration and TEWL mostly stems from within the body itself (Sparr *et al.* 2014:1 & Kikuchi and Tagami 2015:3). The hydration within the stratum corneum is determined by the water gradient across the skin, thus, this hydration determines the skins permeability (Sparr *et al.* 2014:1 & Kikuchi and Tagami 2015:3). This water gradient of how the water content moves between the various layers of the epidermis is captured below in Figure 24B:

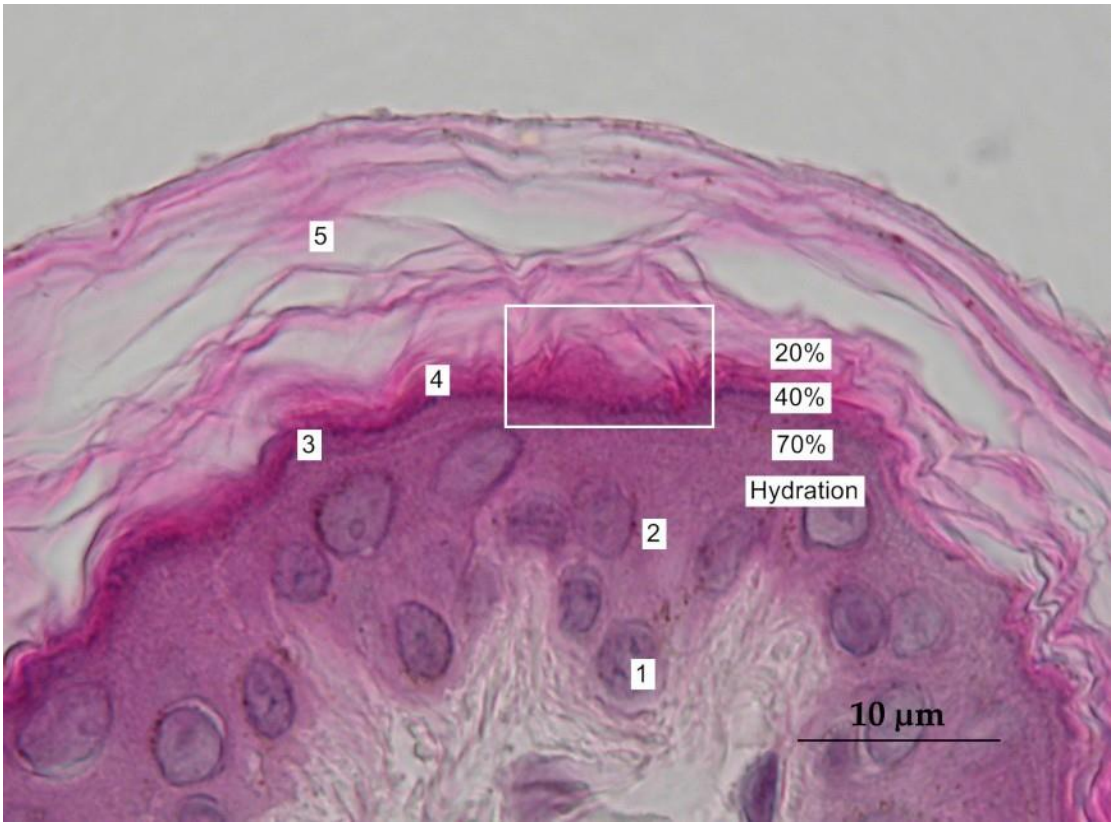


Figure 2.4 B: Microphotograph Epidermis of canine skin: 1 *stratum basale*, 2 *stratum spinosum*, 3 *stratum granulosum*, 4 *stratum corneum compactum*, 5 *stratum corneum disjunctum*, rectangular area shows the location of the skin barrier, the hydration gradient through the epidermis is noted (Pin 2011:6).

As stated previously the water is constantly being lost from the skin's surface and the water gradient is established in the Stratum corneum within the different layers. At the skins surface roughly 15% of water is lost (Pin 2011:4).

Thus, products that are developed to hydrate the skin, typically function as occlusive agents, exfoliants, humectants, or emollients (Saraf *et al*. 2010:2).

One of the most important properties of a cosmetic cream is its barrier function when it is spread onto the skin surface, in addition, it is anticipated to alter the resistance to water evaporation from the skin therefore decrease trans-epidermal water loss (Sparr *et al.* 2014:9 & Loden 2005:2). In a study conducted by Sparr *et al.* (2014:1), skin hydration was analysed with the application of occluding barrier creams, using a theoretical model which transports hydration into skin membranes after the application of a film onto the skin. From the results of the study, they were able to make

quantitative predictions on how films of different formulations affect the water activity at the skin surface, TEWL and the hydration of the upper layer of SC (Sparr *et al.* 2014:9). The Oil in Water (O/W) emulsions investigated, it was noticed that the water resistance was rather low, while higher values for the resistance were observed for Water in Oil (O/W) emulsions (Sparr *et al.* 2014:9 & Moncrieff *et al.* 2013:232). In conclusion they established an increase in skin water activity (TEWL) caused by a film can lead to a significant increase in skin hydration (Sparr *et al.* 2014:9). In addition, throughout their study this effect was most evident at low RH and for thicker films.

2.5 INGREDIENTS OF THE TISSUE OIL WITH ROOIBOS ENRICHED EXTRACT FOR DEHYDRATED SKIN

Tissue enriched oil with Rooibos extract mainly promotes healing, nourishment, hydration and is used as an active ingredient in many cosmetic products available for skin, hair and nails (Sarullo 2014:1 & Szyszkowska *et al.* 2014:175). Rooibos extract blended with the other carrying and essential oils added acts as a strong antioxidant of which prevents premature aging along with treating versatile skin conditions and can be incorporated into your daily diet (Sarullo 2014:1 & Szyszkowska *et al.* 2014:175).

2.5.1 Sweet Almond Oil

According to Rodriguez *et al*. (2000:78) and Pe'rez *et al.* (2014:1), sweet almond nut oil is established as the mechanically expressed oil from the ripe fruit of the tree *Prunus dulcis*, which is a member of the Rose family. Rodriguez *et al*. (2000:78) describes it as a clear or pale straw-coloured, odourless, and sweet tasting oil, with high unsaturated fatty acids content and emollient power, therefore, it is well accepted and widely employed in cosmetics as an excipient, lubricant, sebum-restoring and re-epithelization agent for products. It is a popular ingredient found in natural beauty products because of its emollient properties which helps prevent trans-epidermal waterloss from the skin (Kubala 2017:1 & Lin *et al.* 2017:4). It can be used in many other cosmetic preparations such as moisturizers, lip balms, infant formulations, creams and soap (Rodriguez *et al*. 2000:78 & Kubala 2017:1). It was reported to be nourishing various common skin conditions such as; excessively dry skin, sunburn, and wind burn and under certain conditions, and is a widely used antioxidant to

preserve other natural ingredients. Kubala (2017:1) stated that sweet almond oil is a great source of potent antioxidant Vitamin E.

2.5.2 Grape Seed Oil

Grape seeds are found to be waste products of wineries and are of importance to the agricultural and industrial waste with a diverse use in pharmaceutical, food and cosmetic applications (Sotiropoulou *et al*. 2012:1 & Shinagawa *et al*. 2015:2). Sotiropoulou *et al*. (2012:1) found that grape seeds contain about 14-20% of oil which contains linoleic acid (65-72%), oleic acid (12-23%), palmitic acid (4-11%) and stearic acid (8,5-15%). Linoleic acid and oleic acid are not synthesized in the body itself therefore, products containing it have significant nutritional value.

Grape seed oil has stability and resistance to oxidation reactions because it has high concentrations of flavans such as; tannins, oligomeric proanthocyanosides which are 1000 times more than any other oils (Sotiropoulou *et al*. 2012: 1; Figueroa-Espinoza *et al.* 2015:38 & Garavaglia *et al.* 2016:60). It is not biosynthesized by the body therefore it must be taken solely in the diet or applied topically with cosmetic products rich in tocopherols as it is one of the most important natural antioxidants (Sotiropoulou *et al*. 2012:1 & Garavaglia *et al.* 2016:60).

According to Yildirim (2014:426), grape seed oil is generally used in food and cosmetics as it includes fatty acids and bioactive components.
The most common and practiced methods of extracting grape seed oil are through mechanical extraction (cold-pressed or hot-pressed oil) and chemical or also known as solvent extraction (Sotiropoulou *et al*. 2012:1 & Cakaloglu *et al.* 2018:642). Grape seed oils extracted from the cold-pressed method is generally used for cosmetic products as this method preserves the natural structure of oil by keeping away residual chemicals (Sotiropoulou *et al*. 2012:1; Keneni and Marchetti 2017:327 & Cakaloglu *et al.* 2018:642).

Sotiropoulou *et al*. (2012:2) stated that grape seed oil allows easy absorption by the skin without leaving any oil residue, it is a versatile cosmetic ingredient for sustaining moisture in the skin because it is very light in consistency. The qualities of grape seed oil include: acne fighting, skin tightening and healing, reduction of dark eye circles, hydration, and protection of skin from aging and skin protection against UV radiation

(Sotiropoulou *et al*. 2012:4 & Ma and Zhang 2017:6) These attributes are described below:

2.5.2.1 Acne Fighting

Acne is a skin condition that affects sweat glands and hair follicles, causing inflammation, black heads, white heads, pustules, creates a breeding ground for bacteria and other microbial features in the skin (Sotiropoulou *et al.* 2012:4 & Bergler-Czop and Brzezinska-Wcislo 2013:179). According to Garavaglia *et al.* (2016:4) grape seed oil has toxicity on pathogens in the skin suggesting an antimicrobial feature. Furthermore, the extracted oil from the grape seeds had an inhibitory and toxicity effect on the growth of common acne pathogens; *Staphylococcus aureus* and *Escherichia coli* (Garavaglia *et al.* 2016:4 & Shrestha *et al.* 2012:822). The antimicrobial activity displayed by the phenolic compounds, such as resveratrol, involves the induction of oxidative damage to bacterial membrane especially *E. coli*, without affecting the host cell (Garavaglia *et al.* 2016:4).

2.5.2.2 Skin Tightening and Healing

There is substantial deterioration of the connective tissue leading to the loss of skin elasticity and firmness within the skin (Binic *et al.* 2013: 4 & Lin *et al.* 2017:3). Destabilization is found within the collagen, hyaluronan and glycosaminoglycans within the skin, however, there are two mechanisms of grapeseed oil which assists with this common skin concern: it inhibits collagenolytic effects by protecting the extracellular matrix from subclinical, chronic tissue inflammation and it stimulates the connective tissue metabolism, regenerating the dermal structure (Binic *et al.* 2013:4 & Lin *et al.* 2017:3). Grape seed oil has astringent properties whereby it stimulates biological tissues to contract and draw the skin together whilst fighting free radicals and helping to firm the skin (Aburjai *et al.* 2003:991 & Garavaglia *et al.* 2016:6). It is medically used for various purposes, especially to reduce swelling. For this reason, there are many cosmetic companies that sell countless products using this substance as a main ingredient. Regular application of grape seed oil will deliver a good amount of astringent that is

useful for stimulating the skin and tightening. By applying grape seed oil, the human body can accelerate the wound healing process and can diminish scars. Grape seed extract has been applied to wounds on the skin of animals and humans and it was found that wounds treated with grape seed extract healed more quickly than wounds that did not receive the extract (Aburjai *et al.* 2003:991).

2.5.2.3 Reduction of Dark Eye Circles

Grape seed oil inhibits melanogenesis through a posttranscriptional regulation of tyrosinase gene expressed in cultured B16 melanoma cells which is a potential skin whitening agent found in many cosmetic and pharmaceutical industries (Binic *et al.* 2013:5). Dark circles under the eyes and dehydration are common facial skin problems (Sotiropoulou *et al.* 2012:4 & Soto *et al.* 2015:260). Grape seed oil would not display visible results overnight, but consistent application can eliminate the occurrence and improve the appearance of dark circles without harmful chemicals (Sotiropoulou *et al.* 2012:4). Clinical studies were conducted on six individuals where the effectiveness of the grapeseed oil composition was analysed on dark eye circles, by applying grape seed oil topically to one-half of their face for a period of ten to thirty days (Sotiropoulou *et al.* 2012:4). By using visual inspections in combination with patients acting as their own controls, results indicated an improvement in appearance as the dark circles under patient's eyes appeared much lighter (Sotiropoulou *et al.* 2012:4 & Mcentee 2017:1). According to Mcentee (2017:1), grape-seed oil contains vitamin E and moisturizing fatty acids contributing to its effectiveness in fading under-eye dark circles.

2.5.2.4 Hydration

Hydration of the Stratum corneum is vital for the integrity and maintenance of the skin barrier homeostasis (Lin *et al.* 2017:2). The composition of Natural moisturizing factor (NMF) consists of free amino acids which contribute to the hydration of the SC (Lin *et al.* 2017:2). These amino acids are metabolized into hygroscopic derivatives such as pyrrolidone carboxylic acid from

glutamine and urocanic acid from histidine which have major factors influencing the hydration status of the SC (Lin *et al.* 2017:2 & Pin 2011:3). NMF compounds are traditionally found in high concentrations within the corneocytes and can contribute up to 20% of the dry weight of the Stratum corneum. Thus, they can trap moisture in the corneocyte cytosol (Pin 2011:3). Another major component of NMF is Hyaluronic acid, which naturally offers hydration and structural integrity within the layers of the dermis (Pin 2011:3).

Most types of oils are used as a skin moisturizer (Sotiropoulou *et al.* 2012:4 & Lin *et al.* 2017:4). Grape seed oil is very light, easily absorbed by the skin and does not leave any residue. Clinical studies have shown that topical application of linoleic acid soothed the skin and reduced the trans-epidermal water loss (Sotiropoulou *et al*. 2012:4 & Surini *et al.* 2018:46). Moreover, dehydrated skin has low linoleic acid, which can be restored by the topical application solutions rich in linoleic acid such as grape seed oil, which reduces the epidermal water loss within 48 hours (Sotiropoulou *et al*. 2012:4 & Lin *et al.* 2017:4). Another study mentioned the application of grape seed oil may act as a protective barrier to the skin by forming an occlusive effect, allowing the skin to retain moisture, therefore resulting in decreased TEWL values (Lin *et al.* 2017:4 & Chuarienthong *et al.* 2010:17).

2.5.2.5 Protection of the Skin from Aging

There is a loss of fibrillin-positive structures and a reduction of collagen type VII (Col-7) throughout skin aging which contributes to wrinkles by weakening the bond between the dermis and epidermis (Ganceviciene *et al.* 2012:308). Antioxidants, consist of cell regulators, have direct effects on collagen metabolism and influence collagen production (Ganceviciene *et al.* 2012:308). The antioxidant properties contained in grape seed oil is excellent for minimizing skin aging as they scavenge free radicals triggering fine lines and wrinkles (Chuarienthong *et al.* 2010:2). According to the University of Maryland Medical Center drinking the oil increases the amount of antioxidants in the blood (Sotiropoulou *et al*. 2012:4). According to Brady (2019:1) other

benefits to the skin include the ability to sustain the presence of collagen and elastin, grapeseed oil contains polyphenols which help fight premature aging.

2.5.2.6 Skin Protection against UV Radiation

DNA photodamage and UV-generated reactive oxygen species (ROS) are the preliminary molecular events that lead to photodamaged skin (Ganceviciene *et al.* 2012:309). Protection of the skin against UV radiation through tissue oil act through different mechanisms such as; directly neutralizing free radicals, they reduce the peroxide concentrations and repair oxidized membranes, they quench iron to decrease ROS production and via lipid metabolism, short-chain free fatty acids and cholesterol esters neutralize ROS (Ganceviciene *et al.* 2012:309). The grape seed oil has the potential to protect human keratinocytes against the damages produced by UVB radiation due to their strong antioxidant activity that reduces the free radicals significantly (Chuarienthong *et al.* 2010:2). The antioxidant activity is affected by the high concentration of polyphenols, presented by proantocyanidins, anthocyanidines, catechins. Grape seed proanthocyanidins have been proved to exert skin cancer prevention effects by inhibiting oxidative stress and protecting the immune system (Sotiropoulou *et al*. 2012:4). In another study, researchers established an improved photoprotective capacity where there was a higher degree of the flavonoids' polymerisation and formation of compounds containing gallic acid (Matito *et al.* 2011:4489).

2.5.3 Soybean Oil

Soybean oil is a refined oil obtained from the seeds of Glycine soya (Rodriguez *et al.* 2000:80 & Labu *et al.* 2018:1). According to Waqas *et al.* (2014:1402) and Chuarienthong *et al.* (2010: 2), soybean oil possesses anti-oxidant, anti-proliferative, and anti-carcinogenic activities. Rodriguez *et al.* (2000:80), Huth *et al.* (2015:2) and Labu *et al.* (2018:2) added that it includes constituents which primarily consist of triglycerides of oleic, linoleic, linolenic and saturated acids. Waqas *et al.* (2014:1402), noted that the topical application of soybean oil has been used to improve a variety of common skin conditions; reduce hyperpigmentation on localized areas, enhance skin

tone and elasticity, control sebum secretion, moisturize and hydrate the skin, and delay the regrowth of hair. Rodriguez *et al.* (2000:80) and Sethi *et al.* (2016:280) states this oil is mostly used for its emollient and humectant properties and found in everyday products as bath and shower oils, shampoos and conditioners, cleansing products for the face and body, moisturizing creams and lotions, and sunscreen products.

In a study by Waqas *et al.* (2014:1403) and Jadoon *et al.* (2015:5), when using a cosmetic product containing soybean extract for anti-aging, the results indicated that there were changes in the moisture levels of all the volunteers. The study consisted of volunteers between 25 and 35 years of age. Male volunteers were included, and consent forms were completed and signed. Prior to the tests, a dermatologist examined the participants for any serious contra-indications which included skin diseases or skin damage on the forearms. When observed, there were irregular patterns within the values of skin elasticity, in addition, a regular increase in skin elasticity and skin moisture levels was established after the application of the formulation (Waqas *et al.* 2014:1403).

Waqas *et al.* (2014:1405) indicated that topical application of cosmetic water-in-oil emulsion incorporating 4% soybean extract exerted potential anti-aging and hydrating effects. The non-invasive technique used in this study is a suitable approach for the evaluation of anti-aging and hydrating properties of skin topical agents. (Waqas *et al*. 2014:1405).

2.5.4 Geranium Oil

Geranium essential oil is largely utilized in the perfumery, cosmetic and aromatherapy health and wellness industries all over the world and since it has become an indispensable aromatherapy oil as it is one of the most beneficial skincare oils since it is quickly absorbed (Motsa 2006:5 & Ali *et al.* 2015:591).

Motsa (2006:5) and Ali *et al.* (2015:589) defined an essential oil as a volatile oil stored in extracellular spaces in the epidermis or mesophyll cells of plants. Large amounts of these plants are used in the pharmaceutical, food and the cosmetic industries therefore this has led to an increase in the number of essential oil plant species that are studied for their volatile components (Motsa 2006:5).

The geranium oil has several aromatherapeutic applications as it is added to lotions and body oils for its moisturizing properties (aiding in skin renewal, baths for its cleansing properties, and shampoos or conditioners for haircare (Thomas 2014:1 & Tadimalla 2018:1). Due to its astringent properties, Thomas (2014:1) further stated that for acne sufferers geranium oil decreases sebum production and returns the skin to its normal pH balance, while its wound-healing properties improved the appearance of the post blemishes and acne scars.

2.5.5 Vitamin E

Vitamin E designates the group of compounds which exhibit qualitatively the biological activity of tocopherol (Rodriguez *et al.* 2000:91; Rizvi *et al.* 2014:157 & Combs and McClung 2016:208). Rodriguez *et al.* (2000:91), indicates that vitamin E is an essential nutrient which must be supplied in the diet regularly, however, it is widespread in our food supply and is found mainly in vegetable oils such as canola, sunflower, safflower, olive and wheat germ oil, nuts, whole grains and egg yolks. The key functions of Vitamin E are to protect the DNA, low-density lipoprotein (LDL) and polyunsaturated fatty acid (PUFA) from free radical-induced oxidation, in the body, it is usually present within the cell membranes, plasma lipoproteins and red blood cells as the major lipid-soluble chain-breaking antioxidant in humans, (Rodrigeuz *et al.* 2000:91 & Rizvi *et al.* 2014:157).

There are a few skin care products whom claim to contain ‘‘Vitamin E’’, these products may contain different concentrations and formulations including active Vitamin E, its several esters and many other derivatives (Thiele *et al.* 2007:656). Product formulation data submitted by the Food and Drug Administration (FDA) in 1998 reported α-tocopherol was present in a total of 1072 cosmetic formulations, tocopherylacetate in 1322, tocopherol linoleate in 279, tocopherol nicotinate in 3, tocopherol succinate in 4, potassium ascorbyltocopheryl phosphate in 15, and tocophersolan in 2 cosmetic formulations (Thiele *et al.* 2007:656). While topical α-tocopherol is mostly used at concentrations of 5% or less, products with concentrations of 0.0001% and more than 20% Vitamin E or Vitamin E esters have been developed and marketed in Europe and the USA (Thiele *et al.* 2007:656). According to the data submitted to the Cosmetic, Toiletry, and Fragrance Association (CTFA), Vitamin E acetate was used at concentrations less than 36%, tocopherol linoleate and nicotinate at 62% (the latter

recommended at 0.1–1%), dioleyltocopherylmethylsilanol at 3–6%, potassium ascorbyltocopherylphosphate at 0.02%, and tocophersolan at 60.2% (Thiele *et al.* 2007:656). Notably, there is a lack of published data on dose–response studies defining the optimal dosage of Vitamin E. This is due to limited efficacy control requirements for non-pharmaceuticals, such as Vitamin E (Thiele *et al.* 2007:656).

Recent advances in biophysical and biochemical research have led to the development of non-invasive analysis that will help define relevant dosages of antioxidants such as Vitamin E (Thiele *et al.* 2007:656). Topical formulations containing α-tocopherol at concentrations ranging from 0.1% to 1% are likely to be effective skin care products to enhance antioxidant protection of the skin barrier, as concentrations of more than 2% leads to significantly increased levels of Vitamin E in the stratum corneum causing lipid peroxidation which is found in most rinse off products (Thiele *et al.* 2007:656). According to Keen and Hassan (2016:311), Vitamin E is an important fat-soluble antioxidant and has been in use for more than 50 years within the skincare industry. Furthermore, they stated that it was found to be an important ingredient in many cosmetic products as it protects the skin from various deleterious effects due to solar radiation by acting as a free radical scavenger (Keen & Hassan 2016:311).

The utilisation of products such as tissue oil, with its high bio-active ingredients and Vitamin E in cosmetic preparations, is endless. The benefits of tissue oil enriched with rooibos extract include regeneration, rehydration, and restoration. Together it acts as a powerful anti-oxidant which has a powerful force against free radicals. It's versatility allows for its inclusion into cosmetic preparations for skin, hair and nails (African Extract ™, 2014).

2.5.6 Rooibos Extract

Huang (2006:5) defines the word "tea as infusions made from leaves of *Camellia sinensis*), the evergreen shrub from which green tea or oolong tea is made". Infusions made from herbs like rooibos (*Aspalathus linearis*) are technically referred to as "tisanes". It is now acceptable to refer to herbal infusions as tea because five rooibos tea bags make a tea that is red-brown in colour, hence the name "Rooibos" (meaning Redbush) (Huang 2006:5). According to Gwashu (2016:34) and Perold (2009:32) oral administration of Rooibos was preferred over topical application due to the increased

and easier absorption of polyphenols through the intestine compared to the cutaneous skin. Gwashu (2016:34) further states topical application has been reported to be most beneficial for protection against the effects of UV radiation and moisture loss within the skin.

The use of rooibos dates to more than 300 years ago when the indigenous mountain inhabitants of South Africa, the Khoisan, a tribe of South African bushmen, discovered that the rooibos could be brewed to make a sweet and tasty beverage (Huang 2006:5 & Erickson 2003:36). The use of this plant was recorded by the botanist Carl Thunberg when the tea was introduced by the Khoisan in 1772 (Huang 2006:5 & Erickson 2003:36). Rooibos was collected by chopping the young branches of the wild shrubs in the mountains with axes, bruising the harvest with wooden hammers and leaving it in heaps to ferment (Huang 2006:5 & Erickson 2003:37). Today, the method of harvesting and processing is done in very much the same way but with more advanced technology, refined methods with systematic cultivation and strict quality control throughout (Huang 2006:5 & Erickson 2003:37). Depending on the process, the plant can produce unfermented (unoxidised and green) rooibos or oxidized (fermented) rooibos, commonly used to make tea (Joubert & De Beer 2011:16).

According to Huang (2006:5), before 1925 the tea was exclusively collected from the wild in the mountains. In 1904, a Russian immigrant Benjamin Ginsberg, whose family was involved in the tea industry in Europe for over a century, realized the market potential and started to buy, pack and trade this “tea” collected in the mountains by the Khoisan (Huang 2006:5). Cultivation of rooibos was attempted in about 1925 by Dr. P. le F. Nortier, who was a medical practitioner, and Mr. O. Berg who collected seeds in the Cederberg Mountains. In the 1930’s, Dr. Nortier investigated how to collect the seeds effectively, how to improve germination, and how to handle the seedlings and grow the shrubs in plantations (Huang 2006:5). Dr. Nortier shared his experience with some farmers resulting in rooibos being produced on a larger scale. Ginsberg then bought the tea from the farmers and traded the product globally on a small scale (Huang 2006:5). The demand for rooibos increased dramatically during World War II when the availability of Oriental tea declined due to difficulties experienced with buying and shipping tea from war-ridden Asia. However, the rooibos tea market underwent a severe crisis in 1948 which resulted in establishing the Clanwilliam Tea Cooperative to save the interest of the tea producers (Huang 2006:5).

Over-production of rooibos tea led to another crisis in 1954, after which the Rooibos Tea Control Board was established and stabilised the market once again by improving, controlling and classifying the type of rooibos cultivated and marketed (Huang 2006:5).

2.5.6.1 Botanical Description of Rooibos

Rooibos (*Aspalathus linearis*) is a shrub-like leguminous flowering plant that belongs to the *Fabaceae (Leguminosae*) family (Huang 2006:5; Joubert & De Beer 2011:869). It naturally inhabits the Cederberg Mountain regions, mountains of the Table Mountain series, north-west of Cape Town in South Africa (Patel *et al.* 2016:1; Huang 2006:5 & Erickson 2003:34). The plant can grow up to two meters high, bearing slender branches that may be sparingly or closely distributed. The bark is ferruginous, dark red or purple on the younger branches, becoming grey upon ageing (Huang 2006:5 & Erickson 2003:34). Leaves are simple, long and narrow, ranging from 15 to 60 mm long and 0.4 to >1.0 mm broad (Huang 2006:5 & Erickson 2003:34). The leaves grow straight, may be slightly flattened and rigid, found singly or in bunches. Leaves may range from pale, bright or dull green, rarely light green, often becoming reddish-brown when dried (Huang 2006:5). Small, short lateral teeth may occasionally be found at the base of the leaf. Flowers are found on the tips of the branches, one or up to seven together in terminal racemes or umbels, or in clusters on lateral short shoots. The pea-shaped flowers are pale to bright yellow, often with a touch of purple at the back and base of the petals (Huang 2006:1).

2.5.6.2 Rooibos Antioxidants

Rooibos tea is a powerful antioxidant which is composed of flavonoids and phenolic acids, most of the beneficial effects of flavonoids are attributed to their antioxidant and chelating abilities (Panche *et al.* 2016:2; Saxena *et al.* 2012:130 & Joubert and De Beer 2011:19). These polyphenolic compounds competitively consume the reactive oxygen species thus sparing the target molecule and quench the chain reaction propagating free radical oxidation (Panche *et al.* 2016:8 & Saxena *et al.* 2012:130). They act by donating a hydrogen (H+) atom from their hydroxyl functional groups to the reactive oxygen species (Panche *et al.* 2016:8; Saxena *et al.* 2012:130). As the polyphenols are electron-rich compounds that contain several hydrolysable hydroxyl functional groups, the compound may stabilise itself when an electron is lost after hydrogen donation and thereby not becoming radicals themselves (Panche *et al.*

2016:8). Flavonoids have been scientifically reviewed for their biological properties, apart from being potent antioxidants they also exhibit, among others, hepatoprotective, antithrombotic, antibacterial, antiviral, antitumourogenic, immunostimulant activities and can interact with protein phosphorylation (Huang 2006:9). There are various flavonoid antioxidants they can be identified in rooibos as; aspalathin, nothofagin, quercetin, isoquercetin, orientin, iso-orientin, rutin, luteolin, vitexin, and chrysoeriol (Huang 2006: 9 & Snijman 2007:134). Of the flavonoids identified, aspalathin, rutin and orientin occurred in the largest quantities followed by iso-orientin and isoquercetin (Huang 2006:9 & Snijman 2007:134). The radical scavenging capacity of rooibos flavonoids and tannins, as well as the aqueous extracts and crude phenolic fractions of unfermented and fermented rooibos was evaluated (Huang 2006:9). According to Ajuwon *et al.* (2015:108) in relation to be a free radical scavenger, the various flavonoids containing rooibos have been intensively studied as they are common phenolic compounds found in a variety of fruits and vegetables. The various physiological activities may be associated with stabilizing the reactive oxygen species halting the series of alterations in various cellular, biochemical and molecular changes that ultimately lead to cancer formation (Huang 2006:9).

The water- soluble matter of rooibos tea leaves is approximately half of that of black tea, therefore making the amount of antioxidant activity of rooibos the same volume. The processing conditions of rooibos tea has shown to have a significant effect on the level of antioxidants present (Tiedtke 2002:17).

2.5.6.3 Rooibos and the Skin

Research on Rooibos extract and dehydrated skin have been scarce and limited. However, there were a few studies done and have been reported on how Rooibos influences dehydrated skin specifically. One of the first studies done on Aspalathus linearis dates to 1982 by Hesseling and Joubert (1982:1037) whereby anti-allergenic properties and skin dehydration was evaluated on seven participants diagnosed with either asthma or hay fever. The study revealed that Rooibos tea has potent anti-allergic properties and the skin hydration remained unchanged after the local application of rooibos on the forearm thus, it was questionable for further research (Hesseling & Joubert 1982:1037). According to Tiedke (2002:17) Rooibos extract; when administered internally and applied topically indicated an instant improvement

on a variety of common skin conditions such as eczema, acne and skin dehydration generally, it had a calm, soothing effect on the skin. In another study herbal anti-wrinkle cosmetics which consisted of Ginkgo biloba, Rooibos and Soybean oil was formulated to assess the wrinkles and hydration levels within the skin (Chuarienthong *et al.* 2010:99). The Ginkgo biloba improved the skin wrinkles and hydration by 4.32%, whereby the Rooibos indicated the best wrinkle and hydration efficacy at 9.9% (Chuarienthong *et al.* 2010:99).

A more recent clinical study investigated the effects of rooibos extract on the dehydration of the mouth, eyes and skin, while the objectives were based on saliva flow, tear volume and stratum corneum moisture content (Iwai *et al.* 2018:1).

2.6 NON-INVASIVE THERAPEUTIC TECHNIQUES

According to Vosloo (2009:2), during the last decade somatologists in South Africa have practiced more than beauty technologists and/or cosmetologists. The training Somatologists received enables them to be highly skilled in treating the body to strive towards total wellbeing of a client (Vosloo 2009:2). Furthermore, she stated that the training includes all aspects which include: exercise, nutrition, therapeutic techniques, aromatherapy and reflexology, as well as all the other traditional skincare techniques, thus bringing a more holistic approach to the profession (Vosloo 2009:2).

Non-invasive therapies are becoming more established, many people opt for skincare treatments which achieve results in the minimal timeframe with a rapid turnover (Liu *et al.* 2015:1 & Lewin 2017:346). This study will focus on two techniques namely: The Swedish massage and a hot oil mask which will be described below:

2.6.1 Swedish Massage

According to Mulcahy (2015:1) a Swedish man Pehr Henrik Ling, developed Swedish massage application technique and introduced it into the United States in 1858 as “The Swedish Movement Cure”. He created his system by combining vast knowledge he had of the physiology with Chinese, Egyptian, Greek and Roman techniques.

Swedish massage is the most common and popular type of massage known in the West and is based on the Western concepts of anatomy and physiology (Mulcahy 2015:1 & Bervoets *et al.* 2015:106). The five techniques used are effleurage (stroking),

petrissage (kneading), tapotement (striking), frictions (rubbing) and vibrations, movements have many benefits which are designed to improve blood circulation, soothe the muscles, and reduce tension and mental fatigue resulting in a feeling of well-being and total relaxation (Mulcahy 2015:1 & Zadkhosh *et al.* 2015:323). There are numerous physical, mental and emotional benefits associated with this massage. The physical benefits of Swedish massage that includes: loosening tight muscles and stretching connective tissue, relieving cramps and muscle spasms, decreasing muscle fatigue, loosening joints and improving range of motion increasing muscle strength and calming the nervous system (Mulcahy 2015:1 & Zadkhosh *et al.* 2015:323). Mental and emotional concerns can benefit as well by; mental relaxation, improve length and quality of sleep, relieves stress, anxiety, depression, increase the ability to concentrate and improve sense of well-being (Mulcahy 2015:1 & Zadkhosh *et al.* 2015:323). Furthermore, Swedish massage uses soft strokes on the bone areas and more delicate parts of the body and stronger strokes where there is thicker muscle coverage (Mulcahy 2015:1). This massage therapy can be helpful with several other physical challenges, such as a reduction in scar tissue by physically manipulating the fibres of the tissue, allowing the tissue oil to be successfully reabsorbed into the skin (Mulcahy 2015:1).

According to Cressy (2010:244) massage therapy has beneficial effects on the skin such as the colour of the skin is improved because of the increase in circulation which causes the capillaries to dilate allowing oxygen and nutrients to flow to the skin surface improving skin tone. Furthermore, Cressy (2010:244) explained the removal of waste products is moved more rapidly through the lymphatic system and the sweat glands, cleansing the skin from waste and toxins. Skin texture is improved as the dead skin cells are desquamated from the surface allowing new cells to reach the surface of the skin (Cressy 2010:244). The activity of sebaceous glands is increased, producing more sebum making the skin soft and supple; this helps to keep bacteria from entering (Cressy 2010:244). The skin is nourished externally by the application of special oils or creams applied as a massage medium as this would act as an emollient or humectant preventing moisture loss. Different skin conditions may be treated with the appropriate products (Cressy 2010:244).

2.6.2 Hot Oil Mask with Gauze

According to Edgar (2011:4) oil masks are usually combined with heat treatment, causing blood vessels and pores to dilate and increase the skin's capacity to absorb the oil. Ingredients move through skin and interact with cells quicker when the skin is warm (Edgar 2011:4).

Cressy (2004:136) stated that oil masks could be used on dehydrated, crepe, mature and sun-damaged skin. The action on the skin is soothing and softening due to the nourishing and moisturising properties of the oil as well as the heat produced in the tissues allows for vasodilation encouraging blood, nutrient and oxygen flow towards the skin (Cressy 2004:136). Hypersensitive and extreme vascular complexions are contraindicated to this type of mask where the heat is used as it could aggravate the condition. In this case the mask could be used without the addition of the heat (Cressy 2004:136).

Barnes (2012:723) defined gauze as a thin, open-meshed fabric of loosely woven cotton. It is seen as a time-saver for face and body applications as it is easy to apply and remove as frequent and fast pace treatments are found in professional salons and spas (Barnes 2012:723). Masks are applied either over a layer of gauze or the gauze soaked into the medium or product then spread out onto the skin (Waqas *et al.* 2014:1403). In a similar study, using soybean oil, the gauze was used to hold the oil mask to the arm to prevent it from slipping off while at the same time allowing the ingredients to seep through to benefit the skin (Waqas *et al.* 2014:1403). The heat of the oil increases blood circulation and is very beneficial for dull, dry, dehydrated and mature skin (Barnes 2012:723). Massage is usually not recommended prior to this mask application because blood circulation is increased by the mask itself (Barnes 2012:723).

2.7 PENETRATION THROUGH THE SKIN

Most topical and transdermal drug delivery systems has been analysed and the results have indicated significant advantages in clinical practice for drug targeting to the action site in the body (Ruela *et al*. 2016:527). Many products applied topically onto the skin may penetrate to some extent into the skin layers, where their effects are expected (Ruela *et al*. 2016:527 & Hua 2015:2). Topical treatment formulations commonly used for skin conditions and disorders are for acne, dehydration and cutaneous

inflammatory diseases that include dermatitis, erythematous lupus, and psoriasis (Ruela *et al*. 2016:527 & Hua 2015:2).

The molecular weight of a substance determines whether a product or substance will penetrate the skin thus, the skin will not be able to absorb molecules of a larger molecular weight whereby, hydrophilic solutions would enhance penetration (McGrath 2004:2 & Hagen and Baker 2017:1624). According to Dallmeier (2014:5), generally oils have a smaller molecular weight than most topical treatments, this enables the medium pass through the skin easily (refer to Figure 2.7 A) therefore the molecular weight of an ingredient under 500 Dalton (the standard measurement unit of atomic mass) it passes

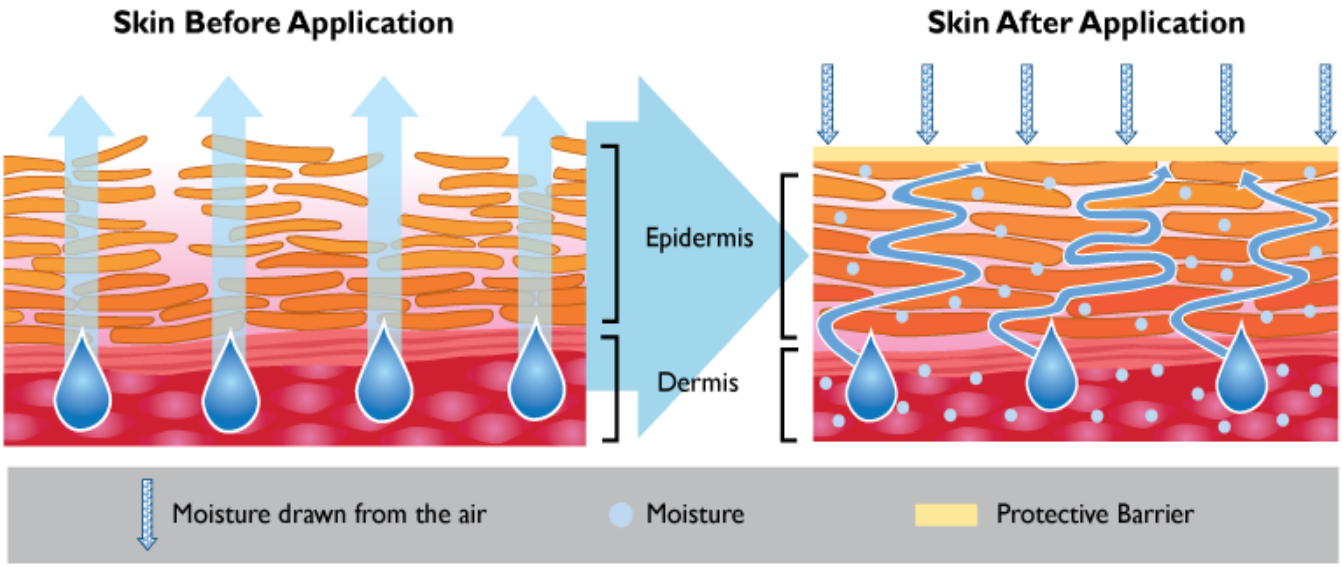


Figure 2.7 A. Application of oil onto the skin to prevent moisture loss within the epidermis (McCarthy 2006).

freely through the top layer of the skin, the stratum corneum creating a protective barrier (Dallmeier 2014:5). Dallmeier, (2014:5), suggested that all tissue oil components have molecular weights well under the 500 Dalton mark, so they pass through the skin with relative ease. Due to the constituents of tissue oil, the product has enabled the affinity for both oil and water (predominantly oil) which makes it effortless to passing through the outer barrier of the skin (African Extract^{TM} Rooibos 2014:1).

A study by Tiedtke, (2002:17) confirmed due to substances that mimic the activity of super-oxide dismutase, rooibos tea possesses significant antioxidant and free radical scavenging properties. Super-oxide radicals are produced in the body due to normal metabolism and external factors such as exposure to microorganisms, UV, pollution and smoking, etc. (Phaniendra *et al.* 2015:14). Super-oxide dismutase enzymes are the body's way of cleaning up excessive quantities of free radicals which can cause irreversible cellular damage, resulting in lipid peroxidation, protein denaturation and DNA mutation within the skin (Phaniendra *et al.* 2015:14). Tiedtke (2002:17) compared the antioxidant and free radical scavenging activities of rooibos with green, black and oolong teas and found that rooibos extracts were stronger free radical inhibitors than either black or oolong tea, but slightly less than green tea on a mass equivalent basis. A well-known international cosmetic company, Cosmetochem, supports the view that teas that are less fermented, such as green tea, tend to show high levels of antioxidant activity (Tiedtke 2002:17).

According to Godic *et al.* (2014:5) when rooibos was applied topically it had the ability to delay aging, rehydrate the skin and even reduce or slow down skin cancer. Ajuwon *et al.* (2015:108) noted that it is because of the high level of flavonoids in the tea, which encourages the body to destroy unwanted pathogens. It was believed that rooibos tea contributes to healthier skin for those suffering from common skin disorders (Mishra 2017:1). Chase (2013:26) stated that alpha hydroxyl acids are common acne remedies, although they can be improved when rooibos tea is applied topically on the skin. Alpha hydroxyl acids rejuvenate the skin by exfoliation and help break down acne comedones, scarring and help remove excess sebum and dead skin cells from the skin which could aid in a disruptive acid mantle causing dehydration within the skin (Chase 2013:26).

2.8 Effects of Aging and the Skin Structure

Skin changes are seen in skin thickness and quality of the epidermis and dermis during the aging process. Recent technical progress has allowed more objective and precise characterization of the aging of the skin (Farage *et al.* 2013:7 & Baroni *et al.* 2012:257).

2.8.1 Epidermal Changes

There are many physiological changes within the skin when the aging process commences; the skin encounters structural, functional and biochemical changes as well as changes in neurosensory perception, permeability, response to injury, repair capacity, and increased incidence of some skin diseases (Farage *et al.* 2013:7 & Amarya *et al.* 2018:4). The cell numbers are reduced in the epidermis in adults the keratinocytes change shape becoming shorter and fatter and the corneocytes become bigger due to decreased epidermal turnover (time taken for the epidermis to replace itself) (Farage *et al.* 2013:7). It was further mentioned; the number of sweat glands does not change although the sebum production decreases up to 60 (Farage *et al.* 2013:7). The water content of aged skin, particularly in the stratum corneum is lower than that of a younger skin (Blackburn 2013:500). The changes in the amino acid composition in aged skin reduces the amount of cutaneous natural moisturizing factor (NMF) thus, decreasing its capacity for the ability to bind water (Farage *et al.* 2013:7).

2.8.2 Barrier Function

A reduction of water content in aged skin enabling an increased trans-epidermal water loss (TEWL) is due to a decrease in the expression of the tight junction components inbetween the cells (Parrish 2017:2). In a study conducted by Farage *et al.* (2013:8), the results indicated that aged skin was more easily disrupted by tape-stripping than younger skin, requiring only 18 strips in individuals over 80 years of age as compared to the 31 strips in young middle-aged adults. The aging skin is more susceptible to maceration, which may lead to development of lesions and common skin conditions (Parrish 2017:2).

Recovery of barrier function was dramatically different as 15% of those older than 80 had recovered barrier function compared to 50% of the younger group (Farage *et al*. 2013:8).

2.8.3 Dermal Changes

According to Roudaut *et al.* (2012:238), dermal thickness decreases with age, with a decrease in vascularity and cellularity. As degeneration of pacinian and Meissner's corpuscles the perception of pressure and light touch stimuli, in addition there is a decrease in the number of mast cells and fibroblasts (Roudaut *et al.* 2012:238). In the dermis, the amount of glycosaminoglycans declines with age, as does the amount of hyaluronic acid produced by fibroblasts and the amount of interfibrillary ground substance (Roudaut *et al.* 2012:238). Skin elasticity remains fairly constant until it decreases and becomes more permanent from the sixth decade of life, however, aging, is inevitably associated with a decrease in collagen turnover (due to a decrease in fibroblasts and their collagen synthesis) as well as elastin (Roudaut *et al.* 2012:238). Elastin has higher degree of calcification in aged skin, with an associated degradation of elastin fibres the collagen cross-links stabilize, whereas collagen bundles become disorganized (Roudaut *et al.* 2012:238).

2.9 CONCLUSION

The primary focus of the study was to compare the hydration of the skin by analyzing the results of the two application techniques with the use of tissue oil enriched with rooibos extract. There is a growing interest in the health benefits of plants grown in South Africa for skincare products. However, the literature remains unclear as to which plant extracts and how they are applied, will work more effectively on certain skin conditions needs to be elucidated. Thus, for Somatologists to be competitive both globally and nationally, in this rapidly growing profession, new effective treatment applications are essential. This will allow treatments to be customized for clients depending on their specific needs or age group. The following chapter will explain the methodology used in this study.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 INTRODUCTION

This chapter will describe and discuss the research methods used to conduct this study. This will include the research approach, sampling strategy, data collection and analytical methods as well as the population size and type.

3.2 STUDY DESIGN

An experimental design was used to determine whether a specific treatment application will influence the moisture content (Creswell 2014:23). A pre-test (reading done before any oil treatment was done on the forearm skin), post-test method was used to take the reading after the treatments.

3.3 RESEARCH SETTING

The research was conducted at the Somatology Wellness Clinic, at Cape Peninsula University of Technology, District Six campus. Permission to conduct the research was obtained through the University's Health and Wellness Sciences Research Committee (refer to Appendix A).

3.4 RECRUITMENT OF PARTICIPANTS

Advertisements (Annexure 1) were placed around the Cape Peninsula University of Technology, District Six campus and surrounding areas. Eighty-four (84) participants were recruited in total and completed the consultation forms, however seventy-five (75) participants were approved for the study. Twelve (12) participants turned out to be non-compliant and one (1) participant had to be excluded due to medication she was taking. The final population of the study totaled sixty-two (62) of which were contacted via e-mail or telephonically to acquire permission to conduct the study, as well as to remind them about consultation times and dates. The participants were sourced from a sign-up sheet.

3.5 STUDY POPULATION AND SAMPLING

Purposive sampling was used to select sixty two (n=62) females between the ages of 18-45 years of age who were clinically diagnosed by Professor Todd an expert dermatologist to provide evidence of existing dehydration. This was done by using a skin Atlas (Annexure 3) after the first consultation. Candidate's with a 3-5 reading on the Fitzpatrick scale were suitable for the study, since skin types 3-5 are less sensitive and less likely to react negatively.

3.6 INCLUSION AND EXCLUSION CRITERIA

Inclusion criteria:

The following criteria were used for selection of participants:

- Demonstrated existing skin dehydration as clinically diagnosed by the prescribed dermatologist
- Females between the ages of 18-45 years
- Fitzpatrick skin type 3–5 classifications only
- No reaction to the 24 hour allergy test

Exclusion criteria:

Participants were excluded from the study based on the following criteria:

- Pregnant or lactating
- Failed to meet the inclusion criteria
- Females with skin diseases and disorders, cuts, bruises, abrasions, skin cancer, recent operations, inflammation
- Males
- Reactions to the 24 hour allergy test
- Use of cosmetic products or any medication to improve hydration of the skin

3.7 RESEARCH PROCEDURE

The study was conducted at the Somatology Wellness Clinic, Cape Peninsula University of Technology, District Six campus. Potential participants were requested to meet with the researcher for a consultation. Participant information (Annexure 2) was completed by the researcher to establish biographical details, lifestyle and health backgrounds. Images were taken with a 13-megapixel camera as stipulated by the dermatologist. The same venue was used each time to ensure similar lighting, distance and positioning. The images, along with the information sheets (questionnaire), were sent to the dermatologist for clinical diagnosis using an ATLAS which measures the hydration on the skin (Annexure 3). After clinical diagnosis, the successful participant met with the researcher for a second consultation where all the required consent documentation (Annexure 4) was completed and accepted. During this consultation, a 24 hour allergy test (pre-test) was conducted to confirm the participant was not allergic to the tissue oil. The researcher wiped the area with surgical spirits and cotton wool and applied some tissue oil (African Extract^{TM} tissue oil with rooibos extract) on the participant's inner elbow. At the following consultation, if the participant presented an allergic reaction, the researcher immediately rinsed the affected area with clean, cool water and applied calamine lotion with cotton wool. Thereafter, the participant would be referred to Professor Todd as she is an expert within the dermatological field for further medical attention. This participant would be excluded from the study.

In order to reduce the influence of altered variables such as different age groups, skin tones, health status, including future variables such as sunlight exposure levels, the two application techniques were administered onto each arm of all the participants.

The application was administered by the researcher as follows:

Massage application:

A 20-minute massage application of the tissue oil (African Extract^{TM} tissue oil with rooibos extract) was applied to the right arm every two, four and six weeks: An amount of 5ml of oil was used with the application of a Swedish massage using effleurage movements for a duration of 20 minutes on the right forearm.

Massage Procedure:

Forearm Massage Sequence - 20 minutes

1. Apply oil with effleurage movement: first radial side x3
   then ulna side x3
2. Stroke around inner elbow x3
3. Stroke outer elbow area x3
4. Single thumb kneading on the inner arm i.e. ulna side x3
5. Single thumb kneading on the outer arm i.e. radial side x3
6. End off with effleurage x3

Hot oil mask application:

Hot oil mask application of the tissue oil (African Extract™ tissue oil with rooibos extract) was applied to the left arm every two, four and six weeks. A piece of gauze was inserted into 5ml of the oil kept at a constant temperature of 25°C (degrees celsius). Once soaked it was wrapped around the left forearm for a duration of 20 minutes.

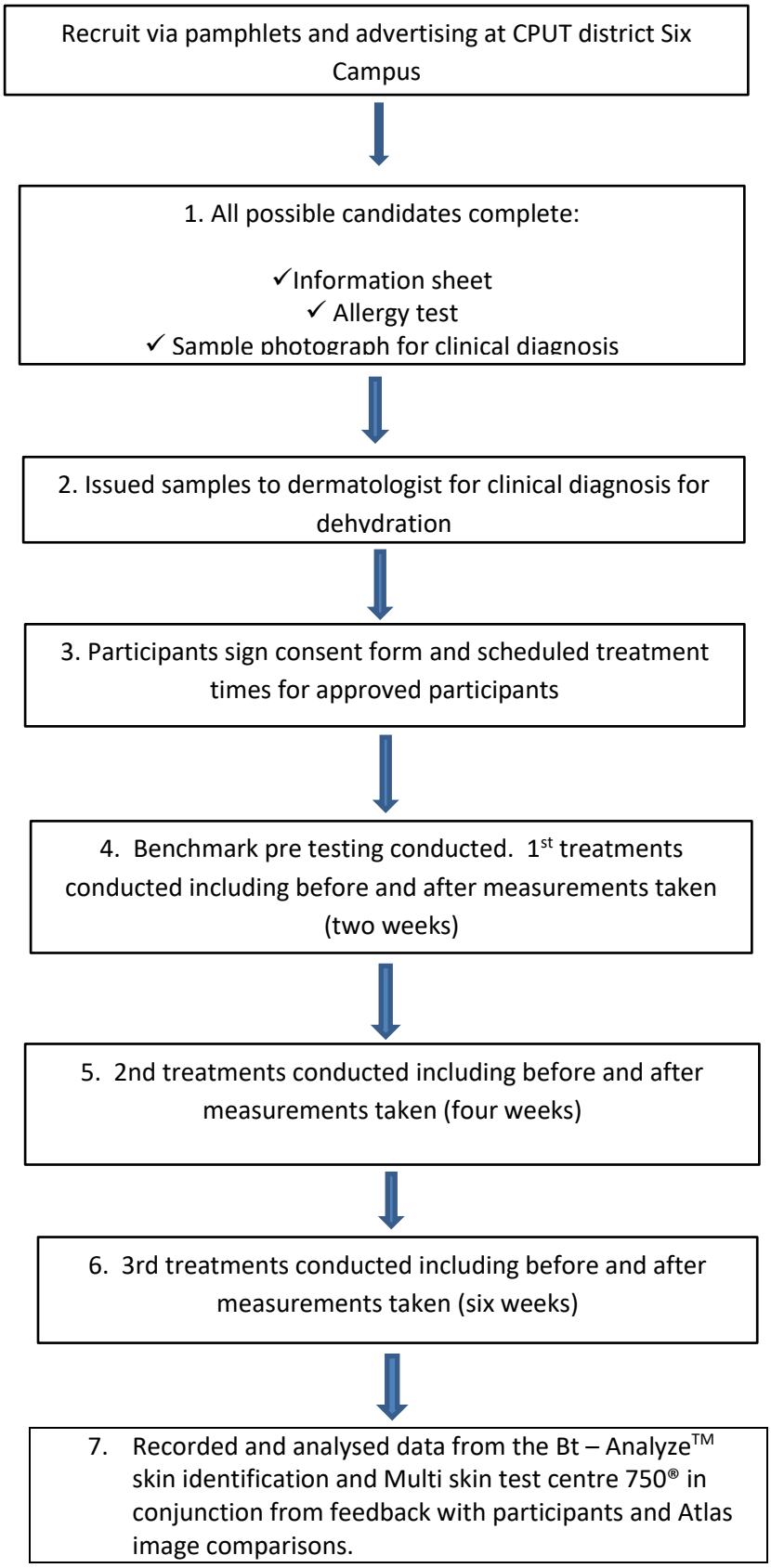
Hot Oil Mask Application Procedure:

- Warm oil
- Soak gauze in warm oil
- Wrap gauze around forearm (squeeze out excess oil before application)
- Leave for 20 minuets
- Remove

The skin was analysed and monitored with the Bt – Analyze™ skin identification and the Multi skin test centre 750® at a two, four- and six-week period to record any developments within the skin. Participants were required to keep a diary to record any subjective changes within the skin's parameters. A consultation schedule (Annexure

5) was given to the participant as a reminder of dates to meet with the researcher. These dates were agreed upon together by the participant and the researcher.

The consultation forms and consent documents were kept by the researcher until all data had been collected. They were stored in a locked cupboard in Room 4.13 within the Somatology Wellness Sciences Department. Only the researcher and co-supervisor had access to the completed documents.



3.7 A: Flow diagram of the research procedure

3.8 DATA COLLECTION AND TOOLS USED FOR ANALYSIS

Following the clinical diagnosis by a dermatologist and consultations including questionnaire with the researcher, follow up consultations for treatment applications were conducted three times (once every two weeks). The participant's skin was analysed and monitored weekly using the Bt – Analyze^{TM} skin identification and the Multi skin test centre 750® which has a 13 megapixel camera, to determine the exact hydration levels. The machine plots and measures the exact area of the arm each time thereby ensuring consistency.

Data from the information sheet, Bt – Analyze^{TM} skin identification unit, Multi skin test centre 750®, and findings from the dermatologist was collated and triangulated and analysed to identify themes, using *SPSS* statistical software package (version 23.0). A probability of $p<0.05$ was utilized. Descriptive statistics and correlational analyses were done. A pilot study was conducted prior to commencing of data collection to determine if any modifications of the tool were needed (refer to 3.10).

3.9 APPARATUS USED TO MEASURE MOISTURE AND TEWL WITHIN THE SKIN

There are numerous devices that measure hydration levels within the skin. According to Truong (2009:2) an instrument capable of measuring skin moisture should meet the following requirements: it must be portable, it should be able to differentiate between dry and moist skin, a display must be implemented in order to give the user feedback, it should have a high sensitivity to moisture and data should be in a form that is intuitive or easily comprehensible. Thus, for this study the following two devices were used:

3.9.1 Bt (Bio-Therapeutic) - Analyze™ Skin Identification

The Bt- Analyze™ skin identification is a hand held, battery operated moisture meter that utilizes bio electric impedance technology with a newly designed and engineered skin membrane sensor. Measurements are calculated against an internal database of statistics to determine the exact final numerical result.

Technical Features

- Dimensions: 3 1/4” x 3 1/4” x 3/4”
- Weight: 1.5 oz.
- Power Supply: 2 AAA batteries

Instructions on how to use the Bt-Analyze™ skin identification

1. The Bt-Analyze™ is turned on by holding the power button for 2-3 seconds.
2. The device will calibrate itself.
3. When the display screen has stopped flashing and the device has beeped twice, the Bt-Analyze™ is ready for moisture readings.
4. Cleanse the skin and wait to dry before applying the Bt-Analyze™ onto the skin.
5. Place the Bt-Analyze™ on the surface of the skin; a beep will signify the reading is complete.
6. Press the memory button to save the reading on the top of the display screen. Readings will save in the order conducted.
7. Press the power button for 2-3 seconds to turn off.

The Bt-Analyze™ works on a measurement range of between 0-65.

- Average Range 25-30 Normal
- Less than 25 show dehydration levels
- Above 30 shows increased hydration levels

To ensure validity, it is recommended that the Bt-Analyze™ measurements should be taken at the same location on the skin each time, to assess client’s progress in maintaining optimum hydration levels in the skin at that precise location.

3.9.2 Multi-skin test centre 750®

The multi-skin test centre 750® is a flexible combination of devices, which allow users to customise measuring parameters for the skin. The specialised equipment offers five programs in one diagnosis system. From a single measurement, the operator has the freedom to select skin parameters and order of measurements.

Technical features and data

Device

Power Supply: Input 100-24V, 50-60HZ. Output: 12V, 4A
Dimensions: 15 X 30 X 5cm
Weight: 1.5 kg
Ports: USB, Firewire

Probes used -

Moisture measurement: Measuring principle: capacitance
Pressure: Approximately 0.16 N/49mm^2
Frequency: 0.9-1.2 MHz

TEWL: Open chamber measuring principle.
Measuring time: 15s

Camera

Dimensions: 12.5cm X5.5cm 4.5cm
Cable length: 1.5m
Weight: 50g
Light source: Visioscope® Colour 32: White- LEDS

Measuring area: 6 X 8mm
Type: 1/3” CCD chip, automatic shutter
Resolution: 640 X 480 X 8 Bit

3.10 THE PILOT STUDY

A pilot is a trial run of the research conducted on members of the research population to determine the viability of the research measurement tool (Leon *et al.* 2011:626). The aim of a pilot study was to determine if both the experts and the participants relate to the questionnaire and if there are any oversights or discrepancies evident in the questionnaire (Leon *et al.* 2011:626).

In order to validate the questionnaire, ethical approval for the project had to be attained. The pilot consisted of a group of experts (dermatologist and somatologists) who validated the questionnaire and methods of data collection. A pilot study was conducted on 10 approved (by the dermatologist) participants.

Additional recommendations and amendments were made to the data collection process as a result of the pilot study:

The "Bt- Analyze^{TM} skin identification" (measurement of the hydration levels within the skin) was included as it has a membrane sensor which calculates the moisture content in the skin which provided the dermatologist with a measurable variable. This equipment poses no discomfort or risk to the participant.

As discussed with the dermatologist certain amendments were made to the participant questionnaire for a more suitable clinical diagnosis for dehydration of the skin:

The Participant Questionnaire: Section 3

3.1 “Does your skin feel dry?” was added to acknowledge that the participant feels that her skin is dry/ dehydrated as well.

An ATLAS (diagram which rates the different levels of dryness within the skin) together with the pictures taken with the multi skin test centre 750® will help produce a better result when before and after pictures are compared.

3.11 THE MEASUREMENT FREQUENCY

Four reminders were sent to each of the 62 participants. One for the allergy test, consent and the remaining three for the follow up appointments for product applications.

3.12 ETHICAL CONSIDERATIONS

Ethical clearance was obtained from the Durban University of Technology, where the researcher was registered, DUT:IREC 084/17(Appendix B).

Ethical clearance was obtained from Cape Peninsula University of Technology as their premises and equipment was used by the researcher, CPUT: REC 28/17 (Appendix C).

All participants were required to read and sign the Letter of Information in keeping with the ethical principle of autonomy.

All questionnaires were coded to ensure confidentiality of each participant. The participants were assured that no harm will come to them should they agree to participate, meeting the principle of beneficence and non-maleficence in research.

Participants' inclusion in the study was voluntary and no remuneration was awarded.

Participants were given the opportunity to withdraw from the study at any point if they so wished.

The data obtained from the study was utilised by the researcher, the research supervisor and the co supervisor only. The data was locked away in safe storage throughout the duration of the research process. The DUT Somatology Department will keep the research data in storage for approximately 5 years, thereafter, all data will be disposed of by means of shredding or deleting electronic copies.

3.13 STATISTICAL ANALYSIS

The initial evaluation of the participant's questionnaire began with checks for completeness and pre and post test data results collected from the various tools. The data was then extracted, coded and captured in an MS Excel spreadsheet and imported into IBM Statistical Package for the Social Sciences (SPSS 23.0) for

analysis. The specific objectives of the study were analysed by using descriptive statistics.

3.13.1 Non Parametric Method

According to Whitley *et al.* (2002:509), Mircioiu and Atkinson (2017:1), non-parametric methods provide an alternative series of statistical methods that require no or very limited assumptions to be made about the data. There is a wide range of methods that can be used in different circumstances, but some of the more commonly used are the non-parametric methods (Whitley *et al.* 2002:509 & Mircioiu and Atkinson 2017:1).

3.13.2 Advantages of Non-Parametric Methods

Non-parametric methods require no or very limited assumptions to be made about the format of the data, and they are preferable when the assumptions required for parametric methods are not valid. Non-parametric methods can be useful for dealing with unexpected, outlying observations that might be problematic with a parametric approach. Non-parametric methods are intuitive and are simple to carry out (Whitley *et al.* 2002:509 & Mircioiu and Atkinson 2017:1).

3.13.3 The *p*-Value

The P-value, or calculated probability, is the probability of finding the observed, or more extreme results when the hypothesis of a study question is true – the definition of ‘extreme’ depends on how the hypothesis is being tested (Whitley *et al.* 2002: 509). If the *p*-value is less than the chosen significance level, then the hypothesis is usually rejected i.e. except if your sample gives reasonable evidence to support the alternative hypothesis, it does not imply a "meaningful" or "important" difference (Whitley *et al.* 2002:509 & Vyas *et al.* 2015:53).

3.13.4 The Mean

The mean (or average) is the most popular and well-known measure of central tendency and can be used with both discrete and continuous data, although it is used most often with continuous data (Whitley *et al.*2002: 509 & Vyas *et al.* 2015:53). The mean is equal to the sum of all the values in the data set divided by the number of values in the data (Whitley *et al.* 2002:509 & Vyas *et al.* 2015:53). An important

property of the mean is that it includes every value in your data set as part of the calculation (Whitley *et al.* 2002:509 & Vyas *et al.* 2015:53).

3.13.5 Standard Deviation

Standard deviation is a measure of the dispersion of a set of data from its mean and determines the variation between each data point relative to the mean (Whitley *et al.* 2002: 509). If the data points are further from the mean, there is higher deviation within the data set (Whitley *et al.* 2002:509 & Vyas *et al.* 2015:53).

3.13.6 The Chi test

The Chi-Square test determines whether there is an association between categorical variables (i.e., whether the variables are independent or related). It is a non-parametric test (Whitley *et al.* 2002:509 & Vyas *et al.* 2015:53).

CHAPTER FOUR: RESULTS

4.1 INTRODUCTION

This chapter will present the results of the data analysis, which will be reported and aligned to the objectives of the study. Results were analysed using SPSS version 23.0. Statistical results were determined by means of different tests such as the *t*-tests, *p*-values and chi-square tests. The significance level for the *p*-values is 0.05 suggesting relevance at 0.05 or lesser difference between the results. The *t*-tests established if there were any significant differences in the compared data results between groups. The Chi-square tests were used to determine the relations between the results and to determine whether the distributions of the variables differ from one another. Relations between variables presented as ($p<0.05$) were considered significant. The descriptive statistics are represented in the form of graphs, tables, photos and statistical commentary.

4.2 RESPONSE RATE

This study required sixty (n=60) participants. The initial number to be recruited was 150 to make provision for participants who might be non-compliant or excluded from the study. Eighty-four (84) participants were recruited in total and completed the consultation forms, however only eighty (80) completed the consent form. Seventy-five (75) participants were approved for the study. Twelve (12) participants turned out to be non-compliant and one (1) participant had to be excluded due to medication she was taking. The final population of the study totaled sixty-two (62).

Table 4.2.1 Indicates the response rate of participants

	Number of participants	**Reason**
Required amount of participants	60	
Initial study population	150	
Completed participant information sheet (consultation forms)	84	
Completed consent forms	80	
Approved consent forms	75	
Non-compliant	12	No longer interested
Excluded	1	Under going TB treatment
Final study population	**62**	

4.3 CONSULTATION QUESTIONNAIRE

To provide a contextual background to the study, data from the participant information questionnaire (Annexure 2) was analysed. The findings are presented below:

4.3.1 Demographics and lifestyle habits

This section summarises the demographics and lifestyle habits of the participants in the Cape Town region. The demographical data included parameters such as age group and occupation. The lifestyle habits relating to TEWL such as water consumption and exercise frequency are also presented.

4.3.2 Age distribution

The study consisted of participants between 18 and 45 years of age. There were 53.2% (n=33) participants between the ages of 18 – 23, with a further 27.4% (n=17) participants in the age group 24–29. The smallest number of participants were found in the age group 30-35 which accounted for 3.2% (n=2). The age group 36-41 comprised 6.54% (n=4) participants while the 42-45 age group comprised 9.7% (n=6) participants.

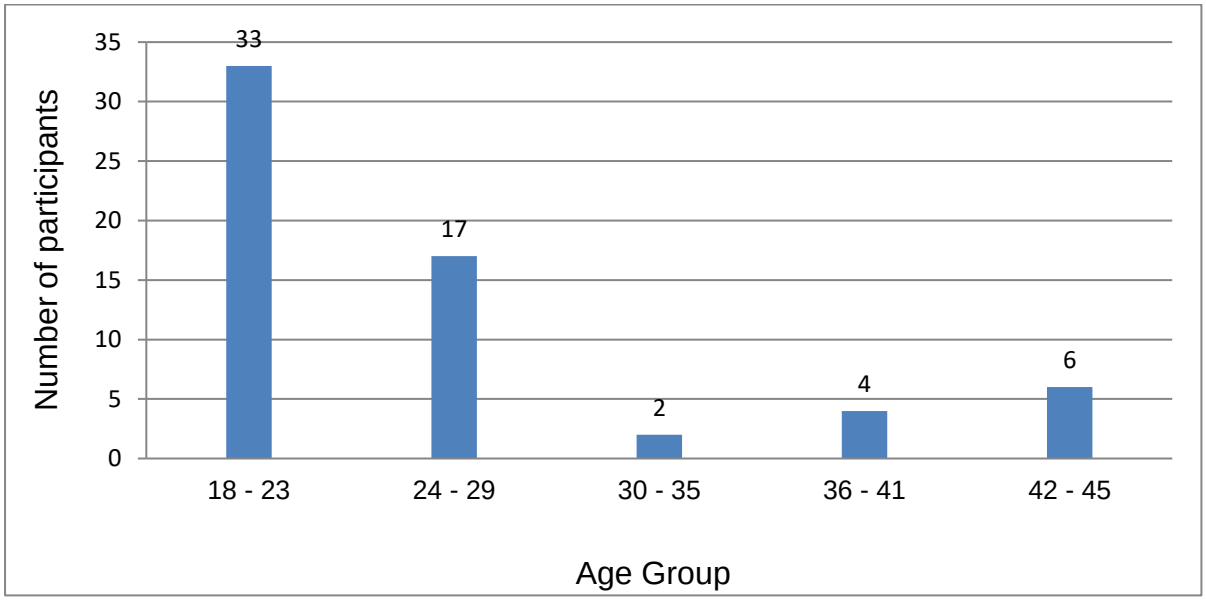


Figure 4.1: Age distribution of participants in the study.

4.3.3 Occupational Status

Most of the participants were from the Faculty of Health & Wellness Sciences with the majority of participants 64.5% (n=40) from the Wellness Sciences Department comprising of Somatology students. The lecturers were the second largest cohort 9.7% (n=6) of participants in this study. Work environment could influence the skin therefore it was incorporated to the study.

Occupation	Frequencies	%
Somatology Students	40	64.5
Lecturers	6	9.7
Admin Assistants	5	8.1
Secretary	5	8.1
Lab Assistant	2	3.2
House wives	2	3.2
Hairdresser	1	1.6
Technician	1	1.6
Total	**62**	**100**

Table 4.3.1: Occupational status of participants in the study.

4.3.4 Lifestyle habits by participants of different age groups

Data on lifestyle habits of participants were gathered using a questionnaire which included questions on body products used, water intake per day and exercise per week. The results are presented below.

4.3.4.1 Body Products usage:

Participants in the age group 18-23 are the greatest consumers and users of body care products, particularly the use of body soap by 85% (n=28), while body lotion was used by 90% (n=30) of the participants. The body lotion appeared to be the most popular choice of treatment in all age groups. The second largest age group was 24-29 of 82% (n=14) of the participants were users of body soap and body lotion. The third age group 36-41 with 75% (n=3). The lowest consumer of all body care products was reflected by age groups 42-45 with 66% (n=4) and 30-35 with 50% (n=1).

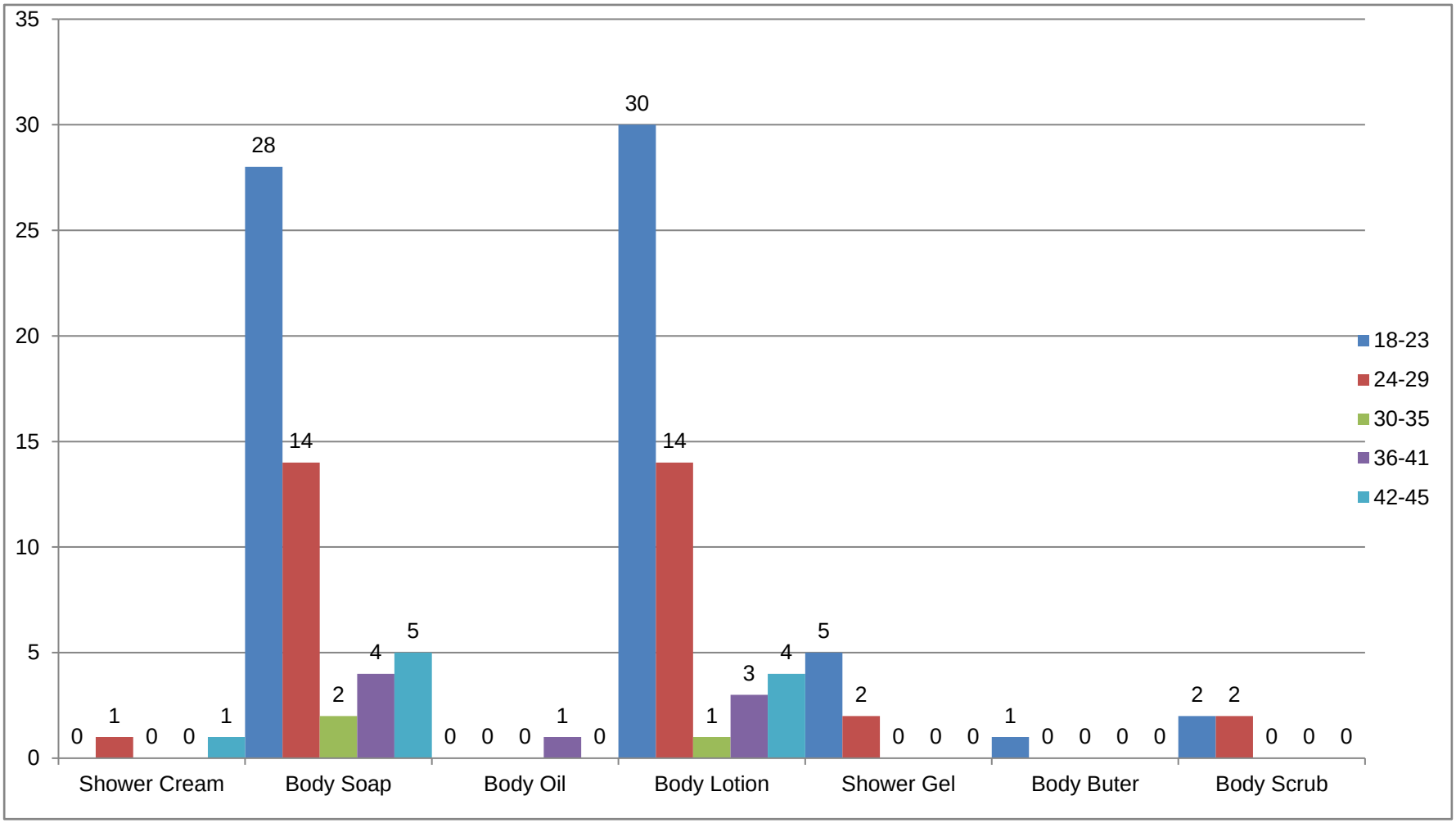


Figure 4.2: Body products used by participants before study was conduct

4.3.4.2 Daily Water Consumption

Participants' water consumption may influence TEWL and hydration levels in the body, thus it is important to establish their daily consumption. In the age group 30-35, both the participants (100%) consumed 6-8 glasses per day. For the age groups, 24-29, 30-34 and 42-45, the average daily water intake was between 3-6 glasses of water. The lowest daily consumption of water was evident for the age group 18-23 with 14 (42%) participants consuming 1-3 glasses of water per day.

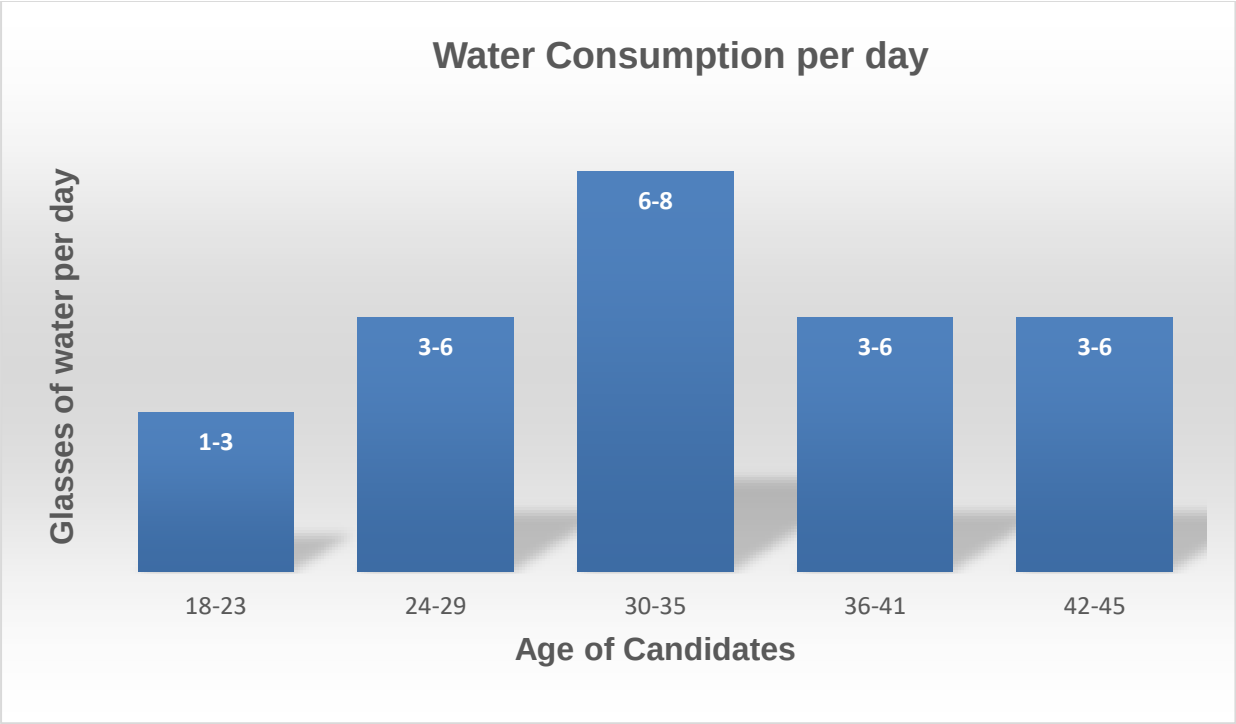


Figure 4.3: Daily water consumption by participants for their respective age groups

4.3.4.3 Exercise Per Week

Exercise may influence TEWL and hydration levels through perspiration. The age group 18-23 comprising of 9 (27%) participants confirmed the highest amount of exercise at 2-4 days a week. Within the age group 24-29 none of the participants did any form of exercise.

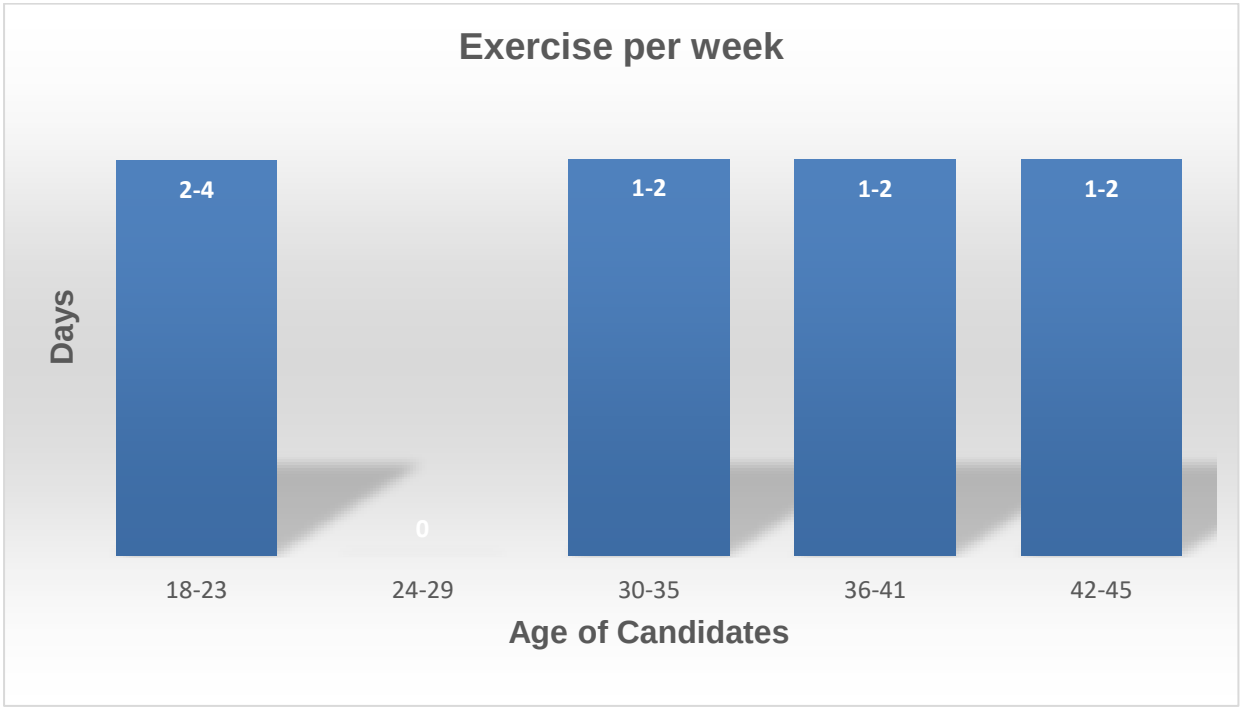


Figure 4.4: Maximum amount of exercise per week by participants for the respective age groups.

4.3.4.4 Hydration Levels Following Hot Oil Mask Application

Hydration levels of the skin were measured following the application of hot oil mask. The pre-intervention and post intervention mean and standard deviation for the hot oil mask application based on results were obtained using the Bt-Analyze^{TM} skin identification. The findings have been separated into the various age cohorts and are presented in the table below, Table 4.6.

Table 4.6: The hydration levels measured pre and post hot oil mask application

AGE GROUP	HOT OIL MASK APPLICATION				
	PRE		POST		P-value
	Mean	Standard Deviation	Mean	Standard Deviation	
18 - 23	28.03	6.19	30.03	6.60	.000
24 - 29	29.25	10.69	31.27	10.80	.000
30 – 35	26.40	2.47	28.80	2.62	.001
36 – 41	32.60	11.18	34.33	11.49	.001
42 - 45	28.45	12.06	31.60	12.19	.000

In Table 4.6, the mean hydration levels for the age groups 18-23, 24-29 and 42-45 were highly significant with a p-value of =0.000. However, overall there were statistically significant differences, $p<0.001$ ($p<0.05$) for age groups 30-35 and 36-41. Thus, the skin hydration levels improved with the application of the hot oil mask for all age groups.

4.3.4.5 Hydration Levels Following the Swedish Massage Oil Application

Hydration levels of the skin were measured following the Swedish oil application. The pre-intervention and post intervention of the mean and standard deviation for the Swedish massage oil application, based on results obtained using the Bt-Analyze™ skin identification are indicated. The findings have been separated into the various age cohorts as presented in Table 4.7 below.

Table 4.7: The hydration levels measured pre and post Swedish massage oil application

AGE GROUP	SWEDISH MASSAGE OIL APPLICATION				
	PRE		POST		P-value
	Mean	Standard Deviation	Mean	Standard Deviation	
18 – 23	29.23	6.31	31.63	6.56	.000
24 – 29	29.30	10.37	31.69	10.45	.000
30 – 35	27.78	1.59	29.78	2.39	.003
36 – 41	33.70	12.65	36.22	13.21	.000
42 – 45	29.59	10.78	32.48	12.65	.000

In Table 4.7, the mean hydration levels of the age groups 18-23, 24-29, 36-41 and 42-45 were statistically highly statistically significant with the greatest improvement recorded. However, the mean difference over all the age groups was statistically significant with a p-value of =0.000 to 0.003 which verifies the improvement in hydration levels with the application of Swedish massage amongst all other groups.

4.3.4.6 Skin Moisture and TEWL Effects post Swedish massage and hot oil application

Moisture levels of the skin and TEWL are interrelated. Thus, the pre-intervention and post intervention of the mean and standard deviation for both the Swedish massage oil application and hot oil mask application, using the Multi-skin test centre 750® were recorded to determine if a possible relationship between different age groups was evident. The findings are presented in Table 4.8, for the Swedish massage oil application and Table 4.9 for the hot oil mask application.

Table 4.8: The skin moisture and TEWL for the Swedish massage application using the Multi-skin test centre 750®.

AGE GROUP	SKIN MOISTURE					TEWL				
	SWEDISH MASSAGE OIL APPLICATION					SWEDISH MASSAGE OIL APPLICATION				
	Mean		Std Deviation		P-value	Mean		Std Deviation		P-value
	Pre	Post	Pre	Post		Pre	Post	Pre	Post	
18 - 23	26.15	29.29	4.60	5.39	.000	4.08	4.68	0.94	0.95	.000
24 - 29	24.42	27.48	4.2	4.11	.000	4.00	4.56	0.99	1.07	.000
30 – 35	27.81	28.68	3.93	3.98	.003	4.20	4.25	0.74	0.75	.363
36 – 41	26.00	29.96	5.73	6.67	.010	3.87	4.68	0.97	0.67	.002
42 - 45	24.11	27.06	5.18	5.45	.021	4.75	5.20	1.01	0.72	.001

Table 4.8 indicates the mean of the skin moisture and TEWL for all age groups pre and post interventions. Skin moisture was statistically significant ($p<0.05$) for all age groups when comparing pre and post Swedish massage application groups.

TEWL values was statistically significant ($p<0.05$) for all ages groups except for the age group 30-35 which had a p-value of 0.363 which indicated no significant difference between the pre and post Swedish massage oil applications.

Table 4.9: The skin moisture and TEWL levels for the hot oil mask application using the Multi-skin test centre 750®

AGE GROUP	SKIN MOISTURE					TEWL				
	HOT OIL MASK APPLICATION					HOT OIL MASK APPLICATION				
	Mean		Standard Deviation		P-value	Mean		Standard Deviation		P-value
	Pre	Post	Pre	Post		Pre	Post	Pre	Post	
18 – 23	24.62	27.58	4.83	5.08	.000	4.72	5.05	1.12	1.13	.000
24 – 29	23.00	26.36	4.33	4.68	.000	4.89	5.29	0.78	0.91	.001
30 – 35	24.86	28.68	3.55	4.07	.004	3.28	3.53	0.60	0.40	.042
36 – 41	23.21	26.51	3.37	4.64	.003	4.89	4.87	0.71	0.64	.952
42 – 45	21.55	26.11	4.43	3.15	.000	5.73	5.83	0.99	0.93	.544

Table 4.9 shows the skin moisture and TEWL values pre and post oil mask application for all age groups. There were significant differences ($p<0.05$) for all age groups when comparing the skin moisture pre and post interventions.

The TEWL values of pre and post hot oil mask application were significantly different ($p<0.05$) for the age group 18-23; 24-29 and 30-35. However, the p-values of age groups 36-41($p<0.952$) and 42-45 ($p<0.544$) were considered not to be significantly different.

4.10 Photographical Skin Hydration Observations

Photographical evidence of skin pre and post hot oil mask application and pre and post Swedish massage method of application was taken to establish which method was the most effective application in improving the hydration levels of the skin as observed using the Bt-Analyze^{TM} skin identification system. The Skin ATLAS was also used as a guide to establish grades of hydration levels in the skin. Photographic findings from each age group are presented below.

4.11 Age Group 18–23

Figure 4.11A and Figure 4.11C depict the visual appearance of the skin of the participant's right arm. Figure 4.11B and Figure 4.11D depict visual appearance of the skin of the left arm a possible indicator of hydration levels. Figure 4.11A is an image of pre Swedish massage oil application while Figure 4.11B is an image of pre-hot oil mask application. Figure 4.11C is an image of post Swedish massage oil application while Figure 4.11D is an image of post hot oil mask application.

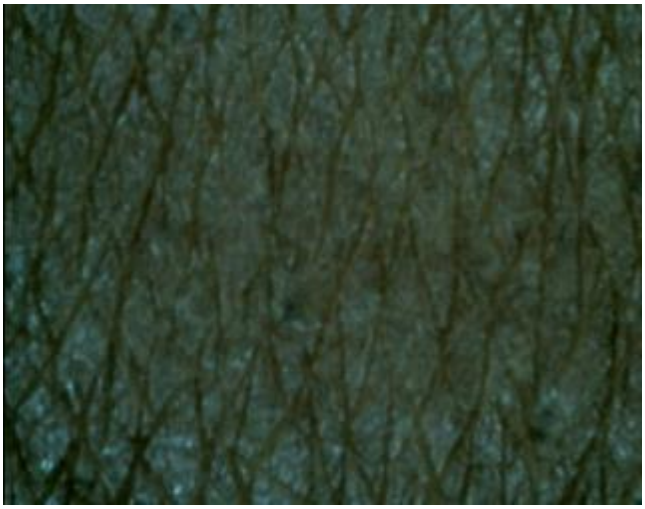


Figure 4.11A: PRESWEDISH MASSAGE OIL APPLICATION

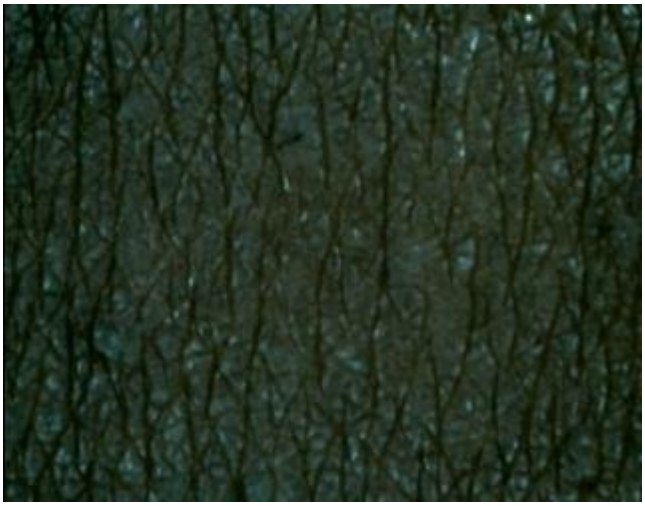
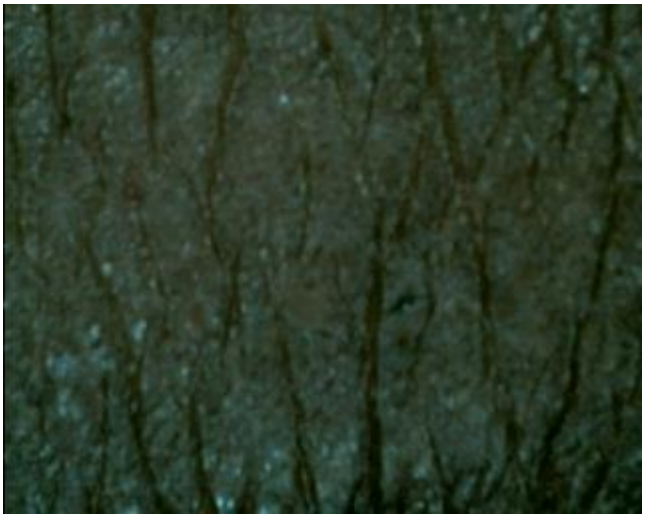


Figure 4.11B: PREHOT OIL MASK APPLICATION



4.11C: POST SWEDISH MASSAGE OIL APPLICATION

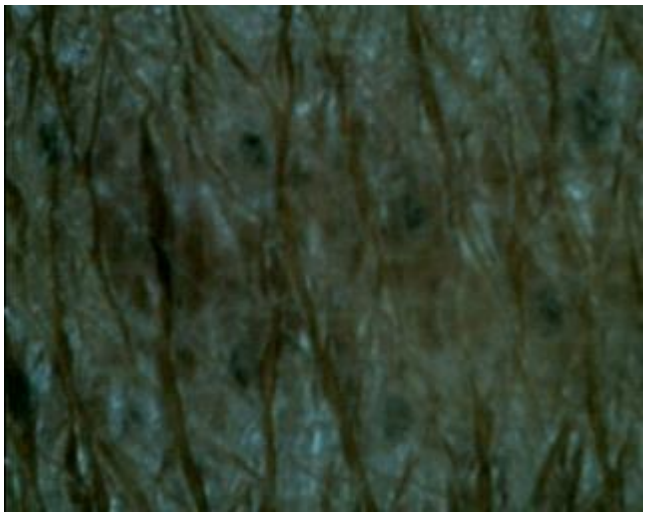


Figure 4.11D: POST HOT OIL MASK APPLICATION

There is a clear indication that the Swedish massage oil application visibly appears to be more hydrating within the 18-23 age groups as illustrated in Figure 4.11C. More visible silver patches indicate that the dehydrated skin remained on the arm after the hot oil mask application as seen in Figure 4.11D. There are less superficial criss-cross lines as seen in Figure 4.11C of which is indicative of a more hydrated skin. The ATLAS grading prior to Swedish massage oil application was recorded at grade 3 and after at grade 1. Prior to Hot oil mask was recorded as a grade 3 and post treatment as a grade 2.

4.12 Age Group 24-29

Figure 4.12A and Figure 4.12C depict the visual appearance of the skin of the participant's right arm while Figure 4.12B and Figure 4.12D depict the visual appearance of the skin of the participant's left arm which recorded the highest hydration improvement levels, using the Bt-Analyze^{TM} skin identification in this age group. Figure 4.12A is an image of pre Swedish massage oil application while Figure 4.12B is an image of pre-hot oil mask application. Figure 4.12C is an image of post Swedish massage oil application while Figure 4.12D is an image of post hot oil mask application.

Figure 4.12 A: PRESWEDISH MASSAGE OIL APPLICATION

Figure 4.12 B: PREHOT OIL MASK APPLICATION

Figure 4.12 C: POST SWEDISH MASSAGE OIL APPLICATION

Figure 4.12 D: POST HOT OIL MASK APPLICATION

Both the Swedish massage application and hot oil mask application indicated similar levels of hydration. The photographs show minimal amounts of dehydrated skin (less silver/grey patches and superficial criss-cross lines) as compared to the previous age group. The skin ATLAS grading prior to treatment was recorded as a grade 2 for both arms and after treatment as a grade 1 for both methods of application.

4.13 Age Group 30-35

Figure 4.13A and Figure 4.13C depict the visual appearance of the skin of the participant's right arm. Figure 4.13B and Figure 4.13D depict the visual appearance of the skin of the participant's left arm, which has the recorded the highest hydration improvement levels, using the Bt-Analyze^{TM} skin identification in this age group. Figure 4.13A is an image of pre Swedish massage oil application while Figure 4.13B is an image of pre-hot oil mask application. Figure 4.13C Swedish massage oil application while Figure 4.13D is an image of post hot oil mask application.

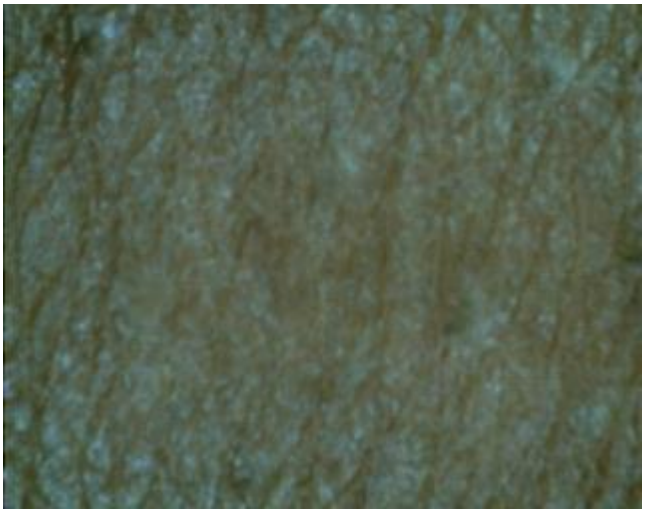


Figure 4.13 A: PRE SWEDISH MASSAGE OIL APPLICATION

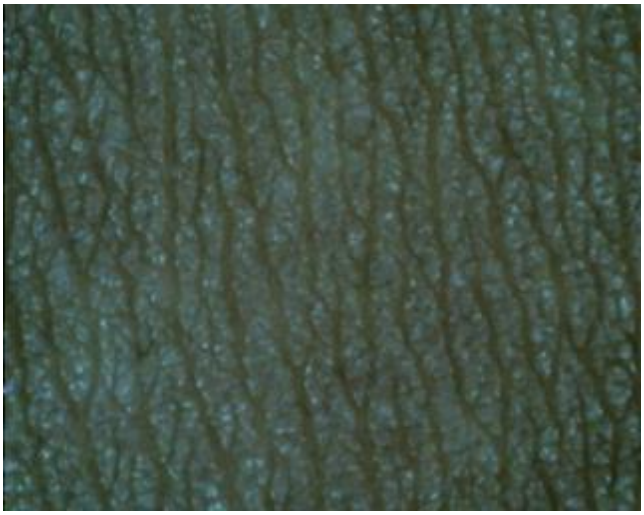


Figure 4.13 B: PRE HOT OIL MASK APPLICATION

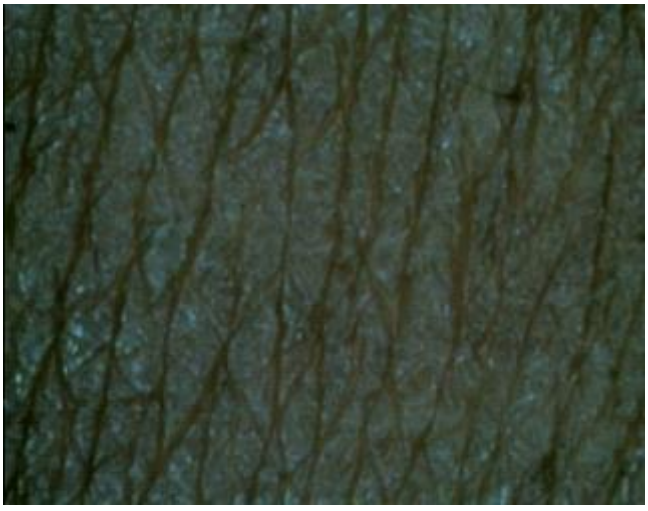


Figure 4.13 C: POST SWEDISH MASSAGE OIL APPLICATION

Figure 4.13 D: POST HOT OIL MASK APPLICATION

There is a clear indication that the hot oil mask application is visibly more hydrating within this age group (Figure 4.13D) compared to post Swedish massage oil application (Figure 4.13C) The superficial criss-cross lines, and silver/grey patches

which indicate signs of dehydrated skin, although reduced, are clearly more visible in the massage photograph. Prior to treatment the skin ATLAS grading was grade 4 on both arms. Post treatment the Swedish massage still had silver patches although some improvement and was recorded as a grade 3 compared to the hot oil mask application that had less scales and recorded as a grade 2.

4.14 Age Group 36-41

Figure 4.14A and Figure 4.14C depict the visual appearance of the skin of the participant's right arm. Figure 4.14B and Figure 4.14D depict the visual appearance of the skin of the participant's left arm which recorded the highest hydration improvement levels, using the Bt-Analyze^{TM} skin identification in this age group.

Figure 4.14A is an image of pre Swedish massage oil application while Figure 4.14B is an image of pre hot oil mask application. Figure 4.14C is an image of post Swedish massage oil application while Figure 4.14D is an image of post hot oil mask application.

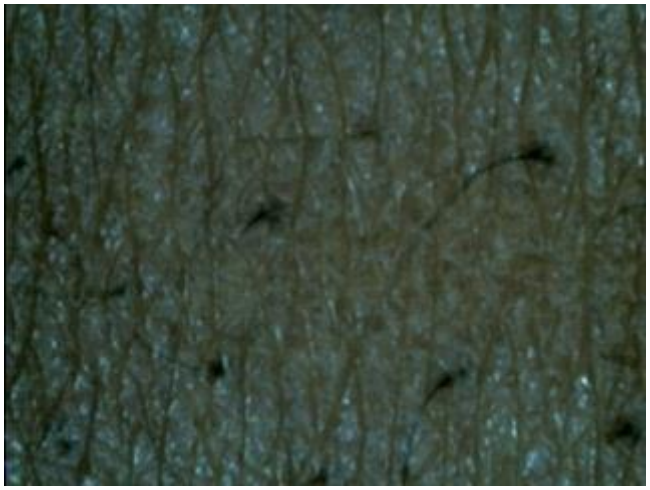


Figure 4.14 A: PRE SWEDISH MASSAGE OIL APPLICATION

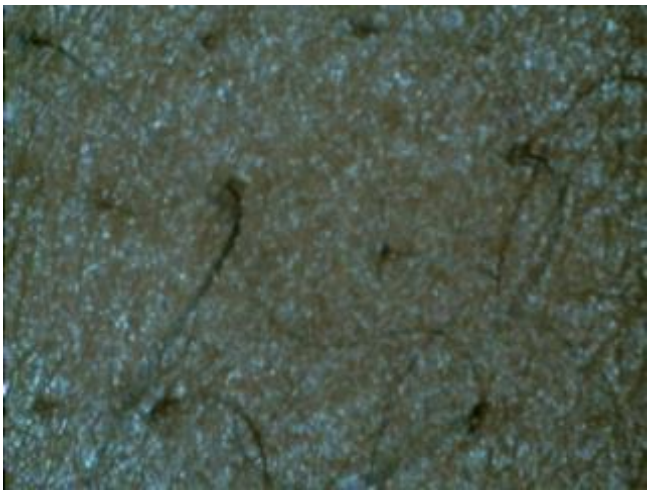


Figure 4.14 B: PRE HOT OIL MASK APPLICATION

Figure 4.14 C: POST SWEDISH MASSAGE OIL APPLICATION

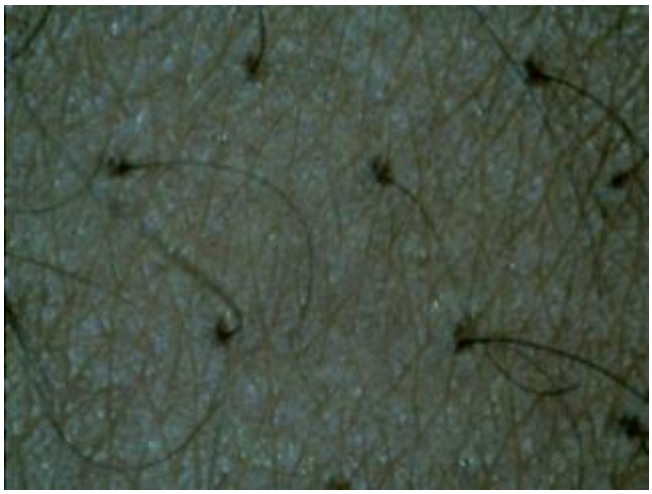


Figure 4.14 D: POST HOT OIL MASK APPLICATION

There is a clear indication that the Swedish massage application is visibly more hydrating within this age group (Figure 4.14C). The superficial criss-cross lines and

silver/grey patches indicate signs of dehydrated skin, improvement is clearly more observed in the hot oil mask method (Figure 4.14D).

Prior to treatment the skin ATLAS grading was 4 with very visible scales. After treatment the Swedish massage improved to a grade of 2 compared to a grade of 3 for the hot oil mask as some of the scaly patches were still observable.

4.15 Age Group 42-45

Figure 4.15A and Figure 4.15C depict the visual appearance of the skin of the participant's right arm. Figure 4.15B and Figure 4.15D illustrate the participant's left arm which recorded the highest hydration improvement levels, using the Bt-Analyze™ skin identification in this age group. Figure 4.15A is an image of pre Swedish massage oil application while Figure 4.15B is an image of pre-hot oil mask application. Figure 4.15C is an image of post massage oil application while Figure 4.15D is an image of post hot oil mask application.

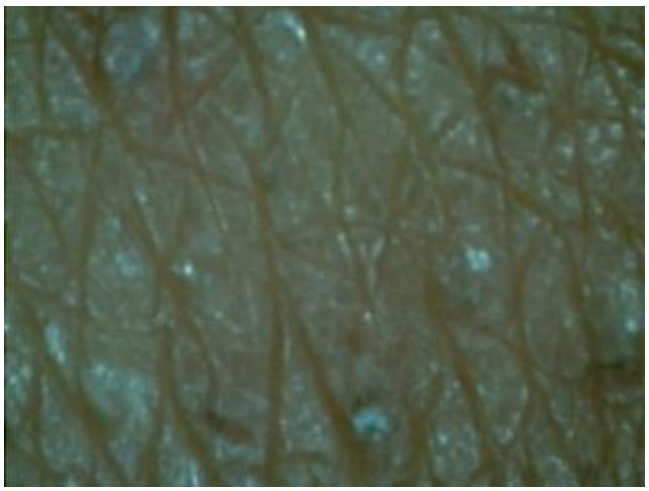


Figure 4.15 A: PRE SWEDISH MASSAGE OIL APPLICATION

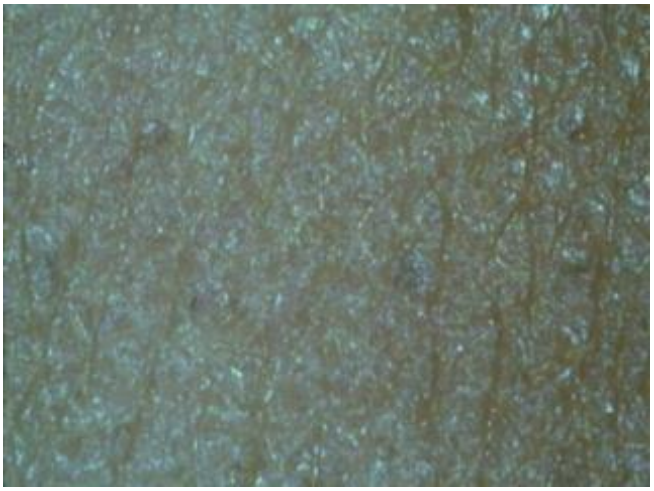


Figure 4.15 B: PRE HOT OIL MASK APPLICATION

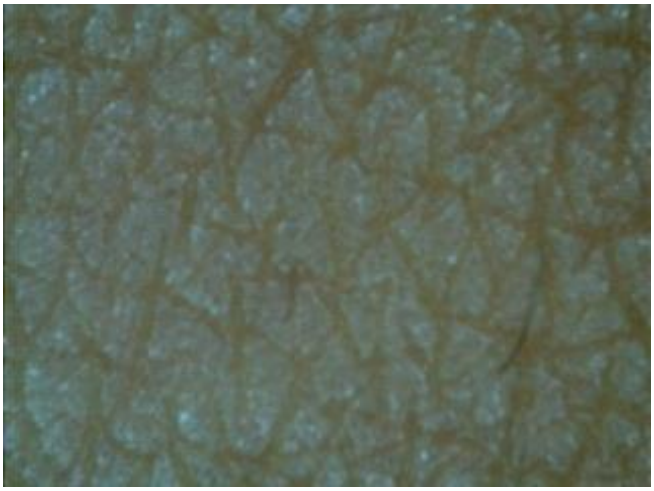


Figure 4.15 C: POST SWEDISH MASSAGE OIL APPLICATION

Figure 4.15 D: POST HOT OIL MASK APPLICATION

There is a clear indication that the hot oil mask application is visibly more hydrating within this age group (Figure 4.15C). The difference between the hydration levels of the two techniques is clearly visible in this participant. The photo of the post hot oil mask indicates more hydration as fewer silver/grey patches and criss-cross lines are observed (Figure 4.15D).

Prior to treatment, coupled with the physical age of the skin, the skin ATLAS reading was a grade 5 and post treatment recorded as a grade 4 for Swedish massage as the lines and patches still quite visible. The hot oil mask improved to a grade 3 as the sliver scales were dramatically improved, however lines still present.

4.16 CONCLUSION

The findings suggest that both the Swedish massage and hot oil mask applications were effective in improving hydration levels of the skin after just three applications. Although minimal, the observation through clinical photographs suggest that the Swedish massage application is visibly more effective for the age group 18-23 and the 36-41. Whereas the hot oil mask application is more visibly effective for the age groups 30-35 and 42-45.

CHAPTER FIVE: DISCUSSION

5.1 INTRODUCTION

In this chapter the findings of this study will be discussed and compared with previous studies that were reviewed in the literature.

In a study conducted by Le Roux (2007:22) with the use of African Extract Rooibos tissue oil applied onto the skin of three participants, measurements were recorded at a 2, 4 and 6 week period and the results indicated an improvement by 24.26% in hydration levels. The same study was conducted a month later with a larger number of 20 participants which indicated an improvement in hydration by 42.9%. These results are in line with the results of this study which found that there was an average improvement of 30% hydration with both application techniques amongst 62 participants at intervals of 2, 4 and 6 weeks apart.

As water cannot be used solely as a moisturizer because the film it forms would be to thin, resulting in evaporation occurring before penetration into the skin happens. Therefore, it is necessary to incorporate ingredients which either are a humectant (assists with water retention), occlusive (prevent water loss) or emollient (to hide the rough scaly condition and comfort) (Bagajewicz *et al.* (2011:8). Thus the oil used in this study contained a number of emollients (grape seed oil and sweet almond oil) to assist with the appearance of the dehydrated skin and address the severely scaly skin.

5.2 DEMOGRAPHIC AND LIFESTYLE HABITS

5.2.1 Age Groups

The age parameters set for this study was between 18-45 years. According to Rammanhor (2014:88) physical aspects of this profession accounted for the fact that mainly young people sought this profession. Most response from participants were recruited on campus within the Somatology Department as this was the first place of advertisement. Age is an important factor since the physiology of the skin also changes with an increase in age (Cerimele *et al.* 1990:13). Most of the participants were in the age group of 18-23.

The skin thickens within the first 20 years of a human lifespan. The correct functioning of the epidermal barrier keeps skin cells healthy, protecting them against external factors and pathogenic micro-organisms. Plumped cells are due to high hydration levels as well as good blood and lymph circulation (Bouwstra *et al.* 2003: 750).

These characteristics of younger skin have a more rapid response to the absorption of the tissue oil as evident for the participants within the age groups 18-23 and 24-29, with both application techniques.

The older age group (42-45 years), particularly in the observation photographs skin's presented with more evidence of dehydration (deeper crisscross lines and silver grey patches). Dehydrated and dry skin is estimated to affect 30% to 60% of all older adults, due to the changes related to the natural aging process (Hurlow *et al*. 2011:1). There is a diminished supply of blood and nutrients. The number of sebaceous and sweat glands are reduced. Results in less lipid production. Due to the thinning of the epidermal layer, the strength of the barrier layer that protects from the skin is compromised. This results in a decrease in the resistance to damage and suppleness of the skin (Hurlow *et al*. 2011:2).

5.2.2 Occupation Status

The results for this study revealed a high frequency of tertiary students accounting for 53.2% of the participants. The high frequency of student participants in this study may be attributed to the study being conducted in a university setting. Thus, the study was easily accessible to the students of the institution. Somatologists, by nature of their profession were interested in this study which accounts for their high participant rates.

These results correlated with the findings of previous studies done at DUT. Schiller's (1999) study indicated that 33% of the study sample were students. In a study by Tsolakis's (2001), 63% of participants were students whereas studies by Pillay' (2001) and Dimopoulos's (2002) reported 65% and 40% student participants in their studies, respectively. Higher dehydration levels may be found in participants who were exposed to air-conditioning, heaters, sunlight at their workplaces (Howard 2017:1). The normal room temperature of any room or work place should be at 25°celsius. If the temperature is found to be higher or in some cases lower than the normal room temperature for extended periods of time this can cause the skin to become dry or dehydrated (Kirschner 2014: 1).Most students spend between 6–8 hours a day in these conditions which would make them suitable participants for the study.

5.2.3 Lifestyle Habits of Participants of Different Age Groups

5.2.3.1 Product Usage

The age group, 18 - 23 displayed a diverse usage of body products: 84% (28) made use of body soap, 90% (30) used a body lotion, 15% (5) used a shower gel, 3% (1) used body butter and 6% (2) used a body scrub. The age group 24-29 reflected the second highest product usage with shower cream used by 5% of the group, 82% made use of body soap, 82% made use of body lotion, 12% used a shower gel and 11% used body scrub. Therefore, the use of more product used (especially soap) on the skin prior to the study prepared the skin for better oil absorption before the study commenced. Soap generally removes the natural oils which protects and lubricates the skin. This is an important contributing factor to a rapid improvement of skin hydration for those two age groups. This could explain the lower TEWL in these age groups as they use more products consistently; therefore, they have improved Natural Moisturising Factors (NMF's) than other age groups in the study. The age group 30-35 only included two participants, both of which, 100% (2) used body soap and 50% (1) made use of body lotion.

According to Packianathan and Kandasamy (2011:1), in dehydrated skin, the lack of moisture leads to fractures in the cellular barrier, leaving the skin tight and stretched. By applying exfoliant, the dying skin cells are effectively removed, and replaced with healthier new cells and moistuiring ingredients can penetrate into the skin to help ease

dry and dehydrated skin conditions (Bagajewicz 2011:7 & Packianathan and Kandasamy 2011:1).

As new skin cells are generated, the external layer of skin cells becomes dense from the skin cells beneath, allowing newly formed cells to surface in a process called desquamation. The rate at which natural exfoliation takes place depends on internal factors such as health, age, and the amount of moisture within the skin (Packianathan and Kandasamy 2011:1).

5.2.3.2 Water Consumption and Exercise

Participants in the age group 18-23 consumed the least amount of water, between 1 to 3 glasses per day; age groups, 24-29, 36-41 and 42-45 consumed 3 to 6 glasses per day and participants in the age group 30-35 consumed the highest amount of water, 6 or more glasses per day.

Most of the participants took part in exercise. Participants of the age group 18-23 were most active, engaged in exercise 2 to 4 times per week in contrast to the age group 24-29 where participants did not exercise. Participants of the age groups, 30-35, 36-41 and 42-45 all engaged in exercise once or twice per week.

According to Mathias *et al.* (1981: 219), increasing the skin surface temperature increases the rate of TEWL. Therefore, it is expected in my study that the participants of the age group 18-23 being the most active group would show a higher TEWL than all the other age groups. According to Boucetta *et al.* (2014:284), menopause causes a high disruption of the barrier function within the epidermis affecting the TEWL. Therefore, the study was conducted with participants up to the age of 45.

5.3 SKIN MOISTURE AND TEWL LEVELS FOLLOWING HOT OIL MASK APPLICATION

BT-Analyze^{TM} readings are recorded from 0-65 and the results were rated between 25-30, an indication of normal hydration levels; if the reading was below 25, this was an indication that the hydration levels were low and a reading above 30 indicated high levels of dehydration.

The participants of age groups 18-23, 24-29, 30-35 and 42-45 had readings within the range of normal hydration levels before the application of the hot oil mask application.

Participants of the age group 36-41 had a high level of hydration before the hot oil application.

Post hot oil mask application, there was an overall increase in hydration levels observed in participants from most of the age groups except the age group 30-35 where hydration levels remained below 30. According to Young (2016:1), during the thirties the barrier function of the skin is increasingly weakened, the metabolic process of the cells starts to slow down, skin moisture loss increases and skin elasticity is reduced. This is the decade when the skin starts to look dull and experience uneven skin tone.

The most significant improvement with the hot oil mask application was within the age group 42-45. Prior to treatment most of the images of this age group reflected between a grade 5 and grade 7 using the skin ATLAS. The skin appeared to be rough, dry and a fine scale was observed. These are often visible when the skin hydration falls below the normal 10% (Saraf *et al.* 2010:2). In addition, this age group reported the least amount of home care products used prior to the commencement of the study, which could contribute to an increased absorption of the oil. When the skin is dry or dehydrated the protective ability is lost and the integrity of the skin suffers (Duncan 2018:1). The heat of the hot oil mask was concentrated on a smaller surface together with the gauze (acts as a barrier allowing the area to have more heat on that surface area), compared to the massage where it was done on a larger surface area. Locally applied, heat can increase the skin blood flow at the site of heat application which assists in an increased absorption of oils within the skin and increased blood circulation (Hao *et al.* 2016:4). Cressy (2004:136) stated that oil masks could be used on dehydrated, crepe, mature and sun-damaged skin which could account for why the older age group appeared to have the most significant improvement.

In this study, it was found that participants of the age group 42 to 45 indicated a moderate intake of water and low physical activity which could also be contributing factors to the hydration levels within the skin.

5.4 SKIN MOISTURE AND TEWL LEVELS FOLLOWING SWEDISH MASSAGE OIL APPLICATION

Participants of all the age groups had recordings within the range of normal hydration levels before the application of the Swedish massage whereas participants of the age group 36-41 had a high level of hydration level before the Swedish massage application. According to Coleman and Stout (2017:2), within the age group 36-41 the functioning of the lymphatic system starts to slow down. Lymphatic drainage (the way your body gets rid of toxins) decreases in speed and the elastic fibres that support your lymph glands break down. There is less sebum production which means the waxy protective on the outer coating makes the skin more vulnerable to harsh environmental conditions such as pollution. Wong and Hollowed (2017:1) stated that this could be recovered with the addition of a Swedish massage due to the stimulatory effect it has on the peripheral nervous endings as it increases vasodilatation of the cutaneous circulation and may increase sebaceous and sweat gland activity and with the application of massage oil hydration was improved. Additionally, the photographical observations in this study, clearly indicated, with all age groups the Swedish massage application showed a greater improvement in the appearance of the epidermis in comparison to the hot oil mask application. The desquamation process may have contributed to the damaged cells removed by healthy cells (Bagajewicz, 2011:7 & Saraf *et al*. 2010:2).

In all the age groups, skin hydration levels increased with the Swedish massage technique and recorded a score within the high hydration range of 30 and above on the scale of the Bt-Analyze^{TM}. As Saraf *et al*. (2010:1) explained a healthy water content is approximately 30%. However this study reports the hydration levels of participants of the age group 30-35 although improved it still remained below 30. These participants presented with the lowest hydration levels prior to the Swedish massage application and therefore was expected to have the lowest improvement compared to the other age groups.

According to Waqas *et al.* (2014:1404), it was found that moisturizing and hydrating remedies, together with massage, resulted in repairing the skin barrier and restoring the water content ability to retain and redistribute water in the skin. It was established that significant differences in moisture values occurred after massage application of

the formulation throughout the study duration (Waqas *et al.* 2014:1404). The study confirmed the enhancement of skin moisture content after the application of formulation due to the presence of flavonoids in the soy bean extract (Waqas *et al.,* 2014:1404). Flavonoids enhance the skin moisture content due to the swelling of corneocytes in the skin surface aspalathin is one of the major flavonoid components of rooibos comprising approximately 20% of the crude extract (Kruez *et al.* 2008: 690).

In this study, there were improvements in TEWL values for all age groups except for the age group 30-35 which indicated minimal improvement between the pre and post Swedish massage oil applications.

Regarding the lifestyle habits of the participants, the products usage was found to be the highest within the age group 18-23 which assists with increasing NMF factors (Visscher *et al.* 2003:298). The natural moisturising factors are responsible for the maintenance of the correct hydration of the epidermis (Boer *et al.* 2016:3). The results of age group 18-23 indicated the most improvement in TEWL, displayed an increase of perspiration due to high exercise activities and low intake of water (Taylor & Moreira 2013:2). The skin temperature, blood flow through skin vessels, number and activity of sweat glands on a given skin area, ambient temperature and humidity influences the TEWL within the skin (Boer *et al.* 2016:3). This is an important contributing factor to a rapid improvement of skin hydration levels for this age group. This could explain the lower TEWL in these age groups as they use more products consistently; therefore, they have improved Natural Moisturising Factors (NMF's) than other age groups in the study.

The participants of the age group 42-45 had a similar improvement with the water intake being higher with less exercise activities and these participants used less products before the study commenced (less skin preparation). In this way, the TEWL was improved, but the amino acid composition in the aging skin becomes weaker and reduces the binding ability of the NMFs (Boer *et al.* 2016:3). According to Palma *et al*. (2012:173), the more water content in the skin, the greater the opportunity for TEWL to occur. The focus should be on slowing the rate of TEWL from an external perspective, so treatment regime should consider incorporating moisturizers or body oils which have humectant properties thus TEWL is reduced (Sethi e*t al.* 2016:279).

The participants of the age group 30-35 did not have an improvement in TEWL levels. Genetics, lifestyle and the environment will determine at which stage the epidermis and dermis start to thin. At the age of 25, the skin begins to age; collagen mass and flexibility begin to deplete approximately 1% a year which could contribute to the low hydration levels within this age group (Ganceviciene *et al.* 2012:308).

All other age groups illustrated a statistically significant improvement in hydration levels. In a study by Van Der Westhuizen (2013:85), it was found that the application of Ylang-Ylang essential oil over larger areas of the skin had more physiological benefits such as an increase in body temperature, a decrease in blood pressure and breathing rate with exposure to essential oils. In this study, it was found that the arm that received the massage had a bigger surface area for the oil to be absorbed resulted in increased hydration.

It must be noted that Fluhr *et al.* (2006) conducted a study on the validity of instruments that assess TEWL on the acute barrier disruption and reported that although some differentiated among gradations in TEWL, the differences were so minor that they concluded they were reliable tools for the assessments.

5.5 THE HOT OIL MASK FOR THE MULTI SKIN TEST CENTRE 750®

According to Farage *et al.* (2012:7), in aging skin there will be many physiological and biological changes as well as changes in neurosensory perception, permeability, response to injury, repair capacity, and increased incidence of some skin diseases. The epidermis decreases in thickness all over the body, particularly in women specifically on the face, neck, upper part of the chest, and the extensor surface of the hands and forearms (Farage *et al.* 2012:7). Skin thickness decreases about 6.4% per decade on average, with an associated reduction in epidermal cell numbers therefore the thinning of the epidermis could be a factor which influenced the TEWL. Global lipid content of the aged skin is reduced as much as 65% and changes in the amino acid composition in aged skin may reduce the amount of cutaneous natural moisturizing factor, thereby decreasing its capacity for water binding (Visscher *et al.* 2003:290). Essential fatty acid deficiency in the more mature skin types results in a compromised cell membrane which inhibits cellular nourishment and oxygen/waste exchange. Additionally, the formation of the skin barrier defense system such as the bi-layers and acid mantle increases TEWL, thereby aggravating NMF retention (Lee *et al.* 2006:293).

5.6 CONCLUSION

When the skin is massaged there is an increase in blood circulation and the dilation of the pores as friction is caused when the skin is rubbed which plays an important role in the increased absorption of the tissue oil. When compared to the hot oil mask, a smaller surface area was covered. It was expected that the heat of the hot oil mask would have resulted in more absorption. This manipulation of the tissue was found to have an effect on the absorption and hydration rate.

Factors such as age, product usage, water consumption and exercise do influence the skin. Therefore, these factors should be considered in the future recommendations for designing treatment programmes for improving hydration levels.

Overall, it was found that both application techniques improved hydration levels within the skin. However, if the results were analysed into the different age groups, taking into account how the demographic and lifestyle habits of the participants could have influenced the outcome, the following was indicated; in the younger age groups (18-23 and 24-29), both Swedish massage and Hot oil mask applications have the same level of improvement, whereas, the age groups 30-35 and 42-45 indicated a higher hydration result with the hot oil mask application and the age group 36-41 showed improvement in hydration with the Swedish massage application.

CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

The use of Tissue oil with rooibos extract, irrespective of application method, has been found to be effective in providing the Somatology profession with the knowledge of increasing the effectiveness of their treatments to improve hydration levels of the epidermal layer of the skin. With the use of the product, the stratum corneum appears to be able to hold more water.

Individuals from different age groups can benefit from the results obtained from the different application techniques. Thus, by incorporating the Swedish massage technique in the younger age groups it will provide those clients with a better result. Whereas the more mature group indicated a rapid improvement with the hot oil mask application as the oil masked the dry scaly appearance. Individuals can benefit from the tissue oil enriched with rooibos exposure even within a restricted time, thus precluding lower incidences of applicability as the treatment requires minimal time which suits most women's busy schedules.

Most participants experienced an average to below average level of dehydration in their skin before the treatment was applied. Higher dehydration levels correlated with the participants who had a demanding occupation and active lifestyles due to less time for consuming water or forgetting about it. The participants, who managed a professional career, as well as the students, indicated minimal use of body products, drank less than three glasses of water per day and those who were exposed to air conditioning daily indicated a higher perceived dehydration during this study. The participants who spent long time in the sun also experienced higher skin dehydration levels.

On completion of the study, all participants showed an improvement in hydration within the physiological parameters of the skin. The skin appeared visibly less dry with less fine lines. Those that previously experienced flaky or tautness were more comfortable post treatment. The texture of the skin that was rough before felt smoother. In general, the tissue oil with rooibos extract had a positive hydrating effect on the skin irrespective of the application method although age did have an influence. Most of the improvements occurred after the first application of the product.

6.1 Future Recommendations:

The age group should be restricted to a certain age which would help eliminate physiological factors.

Water consumption and exercise should be regulated to establish whether these variables would influence the findings.

The exfoliation procedure should be considered before each application for future treatment recommendations to enable an increased product penetration due to the removal of dead skin cells and to establish if these variables further influenced the findings.

Additional time is needed for acclimatizing participants. Although participants were given 5 minutes to acclimatize, future studies should allow a 30 minute rest time to acclimatize so that the TEWL is not compromised.

Specialist equipment should be considered for humidity reading for the TEWL for an accurate reading such as the TEWAmeter TM 300.

Treatment programmes offered to a younger age group should incorporate massage and treatments designed for an older market,including a mask application to improve results.

Many participants commented that there skin appeared more radiant and glowed after the treatments, it would have been beneficial to use a luxmeter, which provides a reading in luxes, which is a unit of light. This would have allowed for a more accurate or objective finding as the photons reflected by the skin could have been recorded.

Factors such as age, product usage, water consumption and exercise do influence the skin. Therefore, these factors should be considered in future treatment programmes for improving hydration levels.

6.2 Limitations

A more even distribution of the number of participants in each age group as some groups only had a few numbers.

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ANNEXURE 1: Advertisement To Recruit Participants

Do You Suffer from dry dehydrated skin?

- **Are you currently experiencing any of the following symptoms?**
- **Dry, itchy and flaky skin**
- **Skin that has white patches**
- **Sensitive tight or even sore skin**

And are:

- **18-45 years' old**
- **Currently, not using any products or medicine for dehydrated skin**
- **Are in good health**
- **Female**

If so and would like to take part in this FREE study to establish how different applications of tissue oil enriched with Rooibos has on the skin.

Please contact us telephonically or via email to set up an appointment.

Telephone: 073 500 9537
Email: raihaanavds@yahoo.com

ANNEXURE 2: Participant Questionnaire

PARTICIPANT QUESTIONNAIRE

Topic*: A comparative study of the application techniques of tissue oil enriched with Rooibos (Aspalathus linearis) extract on dehydrated skin.*

Thank you once again for agreeing to complete this questionnaire. Please read through the questions below and answer to the best of your ability. Any information you may provide will be kept strictly confidential.

NB. Please ignore coding within tables, the codes are inserted for statistical purposes.

1. GENERAL INFORMATION*(please tick (✓) were applicable)*

1.1 Participant no:										
1.2 Occupation:										
1.3 Age:	18-23 years	0	24-29 years	1	30-35 years	2	36-41 years	3	42-45 years	4
1.4 Race*:*	African	0	Coloured	1	Indian	2	White	3	Other (specify)	4
1.5 Fitzpatrick rating	2	0	3	1	4	2	5	3	6	4

2. LIFESTYLE/ GENERAL HEALTH INFORMATION*(please tick (✓) most applicable option)*

2.1 How do you rate your general health?	Excellent			0	Good	1	Fair	2	Poor	3
2.2 Do you exercise? If yes, how often?	Yes	0	No	1	1-2 times a week	2	2-4 times a week	3	Everyday	4
2.3 Do you smoke cigarettes? If yes, how many do you smoke per day?	Yes	0	No	1	1-5 per day	2	5-8 per day	3	8 or more per day	4
2.4 Do you drink alcohol? If yes, how often?	Yes	0	No	1	1-2 times a week	2	More than 4 times a week	3	Everyday	4
2.5 Do you eat fruit and vegetables? If yes, how often?	Yes	0	No	1	1-3 per day	2	3-5 per day	3	5 or more per day	4

2.6 How much water do you drink?	Yes	0	No	1	1-3 glasses per day	2	3-6 glasses per day	3	6 or more glasses per day	4
Are you exposed to sunlight daily?	Yes	0	No	1	1-2 times a week	2	2-4 times a week	3	Everyday	4
Are you exposed to air-conditioning daily?	Yes	0	No	1	1-2 times a week	2	2-4 times a week	3	Everyday	4
2.7 Have you been diagnosed with any health related conditions?	Yes	0	No	1	If Yes, please specify:					2

Are you taking/using any Medication/Preparation					**If yes, how long you have been using the selected medication/preparation (Please tick)**											
					0-3 months ago		0-6 months ago		6-9 months ago		9-12 months ago		12-18 months ago		More than 18 months	
3.4.1 Roaccutane™	Yes	0	No	1		2		3		4		5		6		7
3.4.2 Diuretics	Yes	0	No	1		2		3		4		5		5		7
3.4.3 Retin A®/retinoids	Yes	0	No	1		2		3		4		5		6		7
3.4.4 Cortisone	Yes	0	No	1		2		3		4		5		6		7
3.4.5 Antibiotics	Yes	0	No	1		2		3		4		5		6		7
3.4.6 Vitamin supplements	Yes	0	No	1		2		3		4		5		6		7
3.4.7 Constipation medication	Yes	0	No	1		2		3		4		5		6		7
3.4.8 Other, please specify:																0

3. CONDITION OF THE SKIN

3.1 Does your skin feel dry?	Yes	0	No	1		
3.2. Are there any fine lines on your skin?	Yes	0	No	1		
3.3. Does your skin feel taut?	Yes	0	No	1		
3.4. Does your skin itch?	Yes	0	No	1		
3.5. Is your skin flaky?	Yes	0	No	1		
3.6. Is your skin texture rough?	Yes	0	No	1		
3.7. Does your skin bounce back easily?	Yes	0	No	1		
3.8. Do you have dilated capillaries?	Yes	0	No	1		
3.9 Do you experience any irritation?	Yes	0	No	1		
3.10. Do you use any products on your skin?	Yes	0	No	1	If yes - specify make and products	2

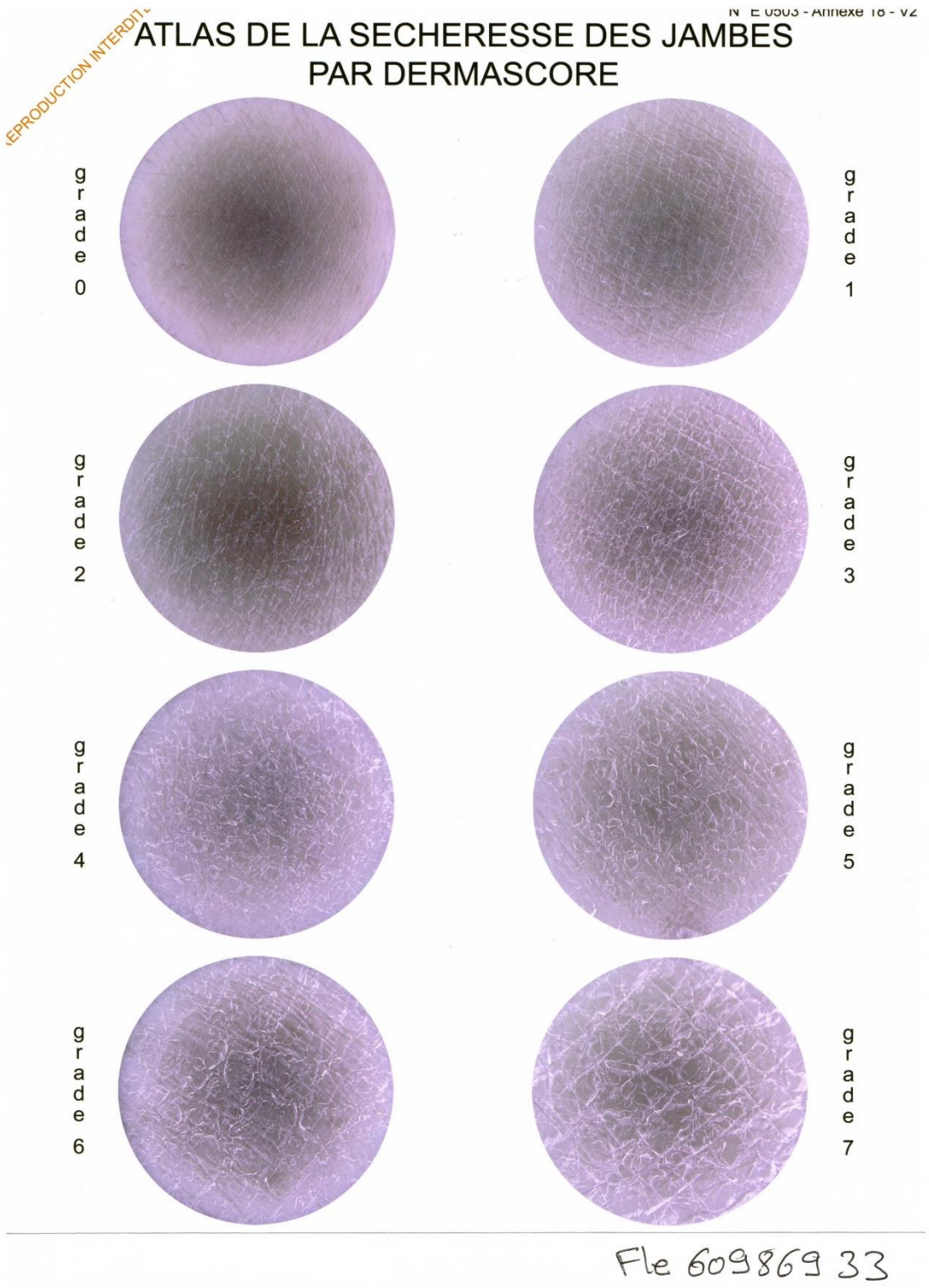
4. **CONTRA-INDICATIONS**

Please Tick (✓) the appropriate box

Viral lesions or infections	☐	Bacterial lesions or infections	☐
Bruises/ cuts/ abrasions	☐	Other: please specify _____	
Recent surgical procedures	☐		
Swelling	☐		
Pregnant	☐		

THANK YOU

ANNEXURE 3: Skin ATLAS



ANNEXURE 4: Letter of Information and Consent

LETTER OF INFORMATION AND CONSENT

Title of the research study:
A comparative study of the effectiveness of application techniques of tissue oil enriched with Rooibos (*Aspalathus linearis*) extract on dehydrated skin of women between 18-45 years of age.

Principal investigator/researcher: Ms R. Van der Schyff
Primary supervisor: Mrs D. Borg
Co-supervisor: Dr N. Brooks

Brief introduction and purpose of the study:
The purpose of this study will be to compare a variety of application techniques of tissue oil to determine if the results will be enhanced and to establish the timeframe in which the results are achieved. Thereby providing the Somatology profession with the knowledge to best increase the effectiveness of their treatments offered to improve hydration levels within the epidermal layer of the skin.
There are no known risks to participation in this study.
Outline of the procedures:
In order to be included in this study, you will need to fulfill the following criteria:

- You must meet with the inclusion criteria of the study as specified in the advert.
- Your skin's condition will be diagnosed by the dermatologist based on images taken and information provided by you to see if you meet the requirements.

The following criteria will exclude you from participation in this study:

- If you do not meet the inclusion criteria
- If you have a reaction to the allergy test
- Currently taking any medication or cosmetic products to moisturize your skin
- If you suspect or are pregnant or lactating
- Any open wounds or skin irritations/disorders

You will be required to consult with the researcher for a total of three times during the period of the study, on the first consultation, a non-invasive skin analysis will be done with the Bt-Analyse® skin identification and photographs taken with the multi skin test centre®. This will be performed by a qualified skin-care therapist in a skin-care clinic at CPUT. If diagnosed with the above mentioned condition you will be included in the study. Follow up visits are included during these consultations. A detailed schedule will be handed to you which includes the

procedures that will take place during these consultations. Each consultation will take around 30 minutes.

Risks or discomforts to the participant:
There will be no risk to you as an allergy test will be conducted prior to you participating in the study. A pilot study will be conducted prior to the study to eliminate any potential risk to you.

Benefits:
Benefits to the participant:
The tissue oil may improve the hydration levels and the overall appearance of your skin.
Benefits to the researcher:
The accolade of a Master's degree in Somatology as well as potential publications in related Journals.

Reason/s why the participant may be withdrawn from the study:
Participation is voluntary and by consent only thus you may withdraw at any time from the research study, there will be no consequences for this.

Remuneration:
There is no direct remuneration for participation in the study. Participation in this study is voluntary. Completion of participating in this study will award you with a complimentary treatment at the Somatology clinic.

Costs of the study:
There will be no costs for participation in the study. However, you may be required to attend a few treatments at the somatology clinic.

Confidentiality:
All information gathered from you will be kept strictly confidential and the results will be used for academic purposes only. Photos, images and information given by you will be viewed and assessed by a Dermatologist for diagnosis.

Research-related Injury:
To avoid any adverse reactions an allergy test will be conducted prior to you being included in the study.

Persons to Contact in the Event of Any Problems or Queries:
If you have any questions or enquiries related to the study, please contact the following personnel:

Principle Investigator	:	Ms Raihaana Van der Schyff	Tel: 073 5009537
Supervisor	:	Mrs Dorinda Borg	Tel: (031) 373 2390
Co- Supervisor	:	Dr Nicole Brooks	Tel: (021) 460 3436

Or the Institutional Research Ethics Administrator on (031) 373 2900.

CONSENT

Statement of agreement to participate in the research study:

•I hereby confirm that I have been informed by the researcher, _____ (name of researcher), about the nature, conduct, benefits and risks of this study- Research Ethics clearance number: _____.

•I have also received, read and understood the above written information (participant letter of information) regarding the study.

•I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.

•In view of the requirements of the research, I agree that the data collected during this study can be processed in a computerised system by the researcher.

•I may at any stage, without prejudice, withdraw my consent and participation in the study.

•I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

•I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

_____	_____	_____	_____
Full name of participant	Date	Time	Signature/ Right Thumbprint

I, (name of researcher) herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

ANNEXURE 5: Consultation Schedule

Consultation Schedule

Once participant is selected the following schedule will be used. Treatments dates and times will be spaced evenly throughout each week at a time agreed upon by both researcher and participant**.**

DATE	DATE AND TIME	CONSULTATION/ACTIVITY
Week 1	Consultation : Treatment 1: Group A	• First consultation (questionnaire, allergy test and photos) • Bt-Analyze™ • Multi skin test centre 750®
2	Treatment 1: Group B	• First consultation (questionnaire, allergy test and photos) • Bt-Analyze™ • Multi skin test centre 750®
3	Treatment 2: Group A	• Bt-Analyze™ • Multi skin test centre 750®
4	Treatment 2: Group B	• Bt-Analyze™ • Multi skin test centre 750®
5	Treatment 3: Group A	• Bt-Analyze™ • Multi skin test centre 750®
6	Treatment 3: Group B	• Bt-Analyze™ • Multi skin test centre 750®

Group A: Participants 1-30

Group B: Participants 31-62

APPENDIX A: CPUT Permission Letter

Cape Peninsula
University of Technology

MEMORANDUM

TO: **DUT Faculty Research Committee**

FROM: Dr. N Brooks

DATE: 24 May 2016

RE: **Permission to use CPUT facilities for MTech project**

Ms Raihaana van der Schyff is currently registered for her Masters in Somatology at DUT for 2016. The topic for her Masters project is "A comparative study of the application techniques of tissue oil enriched with Rooibos (*Aspalathus linearis*) extract on dehydrated skin."

I hereby confirm that all the experimental work for the Masters project will be conducted at the Department of Wellness Sciences, CPUT, Cape Town campus using the facilities and the equipment needed for the project.

I trust that this will meet your approval.

Regards

Dr Nicole Brooks

APPENDIX B: DUT Ethical Clearance

DUT DURBAN UNIVERSITY OF TECHNOLOGY

Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

10 October 2017

IREC Reference Number: **REC 28/17**

Ms R Van der Schyff
130 Duff Street
Parow Valley
Cape Town
7500

Dear Ms Schyff

A comparative study on the effectiveness of application techniques of tissue oil enriched with Rooibos (Aspalathus linearis) extract on dehydrated skin of women aged between 18 and 45 years

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the questionnaire has been APPROVED; you may now proceed with data collection on the proposed project.

Kindly ensure that participants used for the pilot study are not part of the main study.

Yours Sincerely

Professor J K Adam
Chairperson: IREC

DUT DURBAN UNIVERSITY OF TECHNOLOGY
2017 -10- 10
INSITUTUTIONAL RESEARCH ETHICS COMMITTEE
P O BOX 1334 DURBAN 4000 SOUTH AFRICA

APPENDIX C: CPUT Ethical Clearance

Cape Peninsula University of Technology

HEALTH AND WELLNESS SCIENCES RESEARCH ETHICS COMMITTEE (HW-REC)
Registration Number NHREC: REC- 230408-014

P.O. Box 1906 Bellville 7535 South Africa
Symphony Road Bellville 7535
Tel: +27 21 959 6917
Email: sethn@cput.ac.za

4 October 2016
REC Approval Reference No:
CPUT/HW-REC 2016/H35

Dear Ms Raihaana van der Schyff

Re: APPLICATION TO THE HW-REC FOR ETHICS CLEARANCE

Approval was granted by the Health and Wellness Sciences-REC on 15 September 2016 to Ms van der Schyff for ethical clearance. This approval is for research activities related to research for Ms Mzizi at the Durban University of Technology – Department of Chiropractic and Somatology.

TITLE: A comparative study of the application techniques of tissue oil enriched with Rooibos (Aspalathus linearis) extract on dehydrated skin.

Supervisor: Ms Dorinda Borg
Co-Supervisor: Prof Gail Todd

Comment:

Approval will not extend beyond 5 October 2017. An extension should be applied for 6 weeks before this expiry date should data collection and use/analysis of data, information and/or samples for this study continue beyond this date.

The investigator(s) should understand the ethical conditions under which they are authorized to carry out this study and they should be compliant to these conditions. It is required that the investigator(s) complete an **annual progress report** that should be submitted to the HWS-REC in December of that particular year, for the HWS-REC to be kept informed of the progress and of any problems you may have encountered.

Kind Regards

Mr. Navindhra Naidoo
Chairperson – Research Ethics Committee
Faculty of Health and Wellness Sciences