PREVALENCE AND ASSOCIATION FACTORS OF XEROSIS IN MIDDLE-AGED AND ELDERLY IN THAI PEOPLE: A CROSS-SECTIONAL STUDY

BY

MISS ISARA ROJVUTTHIKUN

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF
THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE (DERMATOLOGY)
CHULABHORN INTERNATIONAL COLLEGE OF MEDICINE
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ENTITLED

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ABSTRACT

Background: Aging increases the susceptibility to xerosis include multifactorial etiology factors. Little information regarding the prevalence includes association factors of xerosis in middle-aged and elderly in general aging Thai.

Objective: To identify the prevalence include association factors of xerosis in middle-aged and elderly Thai people.

Methods: A cross-sectional study was conducted at Benjakitti Park Hospital on 18 December 2019 and 23 December 2019. 163 participants aged ≥ 45 years old were enrolled. Questionnaires; demographic data, drugs, personal history, history of allergy, oil supplement, skincare knowledge and skincare utilities, dry air environment, sun exposure, drinking water and DLQI were recorded. Skin dryness was evaluated by clinical score; overall dry skin score (ODS), xerosis severity scale (XSS) and device; corneometer and tewameter.

Results: The prevalence of any degree of xerosis was 100% in middle-aged to elderly Thai people. The mean age was 65.09 ± 6.98 years; 18.40% was male, 81.6% was female. The significant risk factors associated with xerosis (xerosis severity) in middle-aged and elderly were age (OR 1.07, 95%CI 1.01-1.14, caffeine intake (OR 2.48, 95%CI 1.14-5.43), bar soap using (OR 2.21, 95%CI 1.04-4.71), hot/lukewarm

bathing (OR 2.35, 95%CI 1.05-5.27), drinking water less than 8 glasses/day (200ml/glass) (OR 2.22, 95%CI 1.04-4.76). In subgroup middle-aged found Thai nationality significantly associate with xerosis(OR 0.22, 95%CI 0.07-0.76).

Conclusion: High prevalence of xerosis in Thai middle-aged and elderly. Predicting xerosis might be the problem in an earlier age in the general Thai population. The physiologic aging of skin, lifestyle factors could play a role in skin dryness.

Keywords: Xerosis, Dry skin, Middle-aged and elderly, A cross-sectional study, Thai people, Prevalence, Risk

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LIST OF ABBREVIATIONS

Symbols/Abbreviations	Terms
AU	Arbitrary units
α	Alpha
AQP3	Aquaphorin-3
B	Body Mass Index
β	Beta
CE	Cornified cell envelope
DLQI	Dermatology Life Quality Index
EEMCO	European Group on Efficacy Measurement and Evaluation of Cosmetics and other Products
EFAs	Essential fatty acids
FLG	Filaggrin gene
GDS	Generalized dry skin
LDS	Localized dry skin
NMF	Natural moisturizing factor
NEF	Nerve elongation factor
ODS	Overall dry skin score
SB	Stratum basale
SS	Stratum spinosum
SG	Stratum granulosum
SC	Stratum corneum
SPRs	Small proline-rich proteins
TDC	Tissue dielectric constant
TEWL	Transepidermal water loss
TGs	Transglutaminase
VAS	Visual Analogue Score
VP	Vapor pressure

Symbols/Abbreviations	Terms
XSS	Xeronic severity scale

CHAPTER 1
INTRODUCTION

Dryness of the skin, known as xerosis, is characterized by white color, crack appearance with fine scale, irregular surface and an elevated fissure. Xerosis may appear at any generation, nevertheless, it is founded often in the elderly who age over 65 yrs. The outer layer of the skin, stratum corneum (SC) layer is undersupplied water and its capacity to maintain skin hydration leading to the pathogenesis of skin dryness and rough in old age. An epidemiological study in primary and secondary care, xerosis is correlated with elderly age(1-4)and the study shows over half 55.6-58 % of xerosis patients had aged 65 or older (4, 5).

Skin aging process described in two distinct phenomena, intrinsic aging which is skin change in losing barrier function, decreasing water content as well as lipid compound in stratum corneum, decreasing the content of epidermal filaggrin effect of increasing xerosis. Extrinsic aging or photoaging causes dry skin by increased compression of stratum corneum, increased density of granular cell layer, epidermal atrophy, reduced epidermal mucin complementary (6). Numerous etiology factors include pollution, environmental humidity, cold and dry air, for instance living in winter seasons or air conditioning, smoking, dehydration, the use of harsh irritable products, frequency of bathing, female sex who post-menopausal due to hypoestrogenism (7, 8)can contribute to xerosis in older adults. The xerosis condition splits and cracks epidermal and occurs pruritus secondary to produce scratching lesions. Subsequently skin eruption of asteatotic eczema and skin breakdown, which makes the skin vulnerable to infection. The progression of dry skin can be assessed by many methods. The regular common used in dermatological and healthcare studies evaluated by self-questionnaire base, visual analog scale or observation clinical examination by dermatologists' specialists (9). For investigations of dry skin such as measurement of transepidermal water loss (TEWL), corneometer device is considered to detect skin hydration.

Aging increases the sensitivity to attacking skin from the environment and

predisposing to skin diseases. Xerosis is a frequent skin presentation in the elderly and any age however there is less regarding the prevalence include association factors in middle-aged and elderly in the healthy aging Thai. Aims of the current study to determine the prevalence of xerosis in middle-aged and elderly in Thai people. The secondary aim to encounter associated risk factors in the middle-aged and elderly. This article might be promoting skincare in the elderly community for long term care in the future. The network of society will motivate geriatrics groups, their family and friends to recognized skin dryness care. In the middle-aged and elderly population require attention to their physical and physiologic problems and comprehend the skin dryness and its associated factors of middle-aged and elderly.

CHAPTER 2
REVIEW OF LITERATURE

2.1 Xerosis

2.1.1 Introduction

Skin dryness establish an essential health problem in the elderly. Long-term exposure to this skin problem contributes to stressful situations and impaired quality of the elderly person's life. Individuals elderly age, they are at risk for skin dryness and disabling function skin moisture conditions. As a result of physiologic dysregulation, such as the depletion of transepidermal water content, depletion the content of epidermal filaggrin, a decrease of sebaceous gland production as well as sweat gland which nourish and sustain moisture in the environment are the impair barriers for the intrinsic aging process (10, 11).

Nowadays more medical healthcare search prevalence and risk factor that relevance for xerosis and itch symptom condition in elderly and try to enhance awareness of skin conditions in ageing skin.

2.1.2 Epidemiology

The geriatric population who over 65 years of age, was significantly associated with xerosis. The old prevalence of xerosis cutis in an older population studying in resting homes or primary care unit reporting ranges from 29.5% to 58.3% (1, 4, 12). One observational study reported the prevalence of xerosis in the elderly found 55.6%. The older age, female sex, treatments potential relates xerosis, itching during sweating, a history of dry skin and a history of atopic dermatitis were significantly associated with xerosis cause (4). In Thailand, the prevalence of elderly skin diseases related to age, sex, and seasonal change were determined in the out-patient dermatologic clinic, Siriraj Hospital. It founded that the most common dermatologic diseases in 516 elderly patients were eczematous dermatitis 161 (31.2%) which the most common type was xerotic eczema 53 (10.3%) comparing with other types of dermatitis. The significant area sites of xerotic eczema were trunk and leg. The most frequently reported that skin dryness contributed to pruritis symptom and more

aggravating drying of the skin when exposing cold environments and low humidity in the air especially during the winter months or cold temperate. Skin dryness manifests as roughening and fine scaling and can result in complications such as dermatitis and secondary infection of the skin, degrade their quality of life (13, 14).

2.1.3 Etiology and pathogenesis

The intrinsic factor is involving several factors in chronologic changes that occur throughout the skin caused by oxidative damage, cell senescence, amino acid racemization, and glycosylation of protein. Many changes in functional and morphologic skin in aging were studies. In aging, keratinocyte senescent cells are long persistent. And in dry skin area which remarkable dryness especially in the lower extremities in the elderly associated with epidermal filaggrin decreasing. Filaggrin protein in epidermis aggregated of keratin filaments turn to macrofibrils and released amino acid responsible for water retention in SC. Its lack results in scaling and defect barrier function. Pathophysiology of xerosis is disturbance apoptosis in keratinization, slower epidermal turnover rate. Filaggrin generation deprivation, lipid structure in epidermis decreasing, and dehydrate water content in stratum corneum also the pathogenesis of xerosis. (6). Aging decreases in sebaceous gland activity and depletes the skin's moisture. Lower sweating production over 70% in healthy older compared with younger age. Sebum production is an exponential decrease in both males and females probably due to a decrease in gonadal or adrenal androgens production (6). Deficits in skin hydration from evaporating of water loss in the epidermis inside out of keratinocytes (corneocytes) leading to the formation of the skin scales. Another component like cornified cell envelop which covering lipid around corneocyte still important for barrier water loss in SC from outside, maintains the skin's water content. Rogers et al., 1996 (15) described the relationship of decreasing all intercellular lipids and impairment of ceramide 1 linoleate and increasing age particularly decreasing remarkably it level in the winter period. Bernard et al., 2001 (16) analyzed corneodesmosome which components in the cornified layer of the epidermis degradation in normal skin and winter xerosis skin with conventional and freeze-fracture electron microscopy. They demonstrated the persistence of corneodesmosome in the upper stratum corneum of winter xerosis skin when compared with the absence

of corneodesmosome in normal skin supporting the result of abnormal desquamation in xerosis pathogenesis. Still report retaining corneocyte plus expressing premature involucrin and formation of the cornified envelope causing main pathogenesis of xerosis (17). Some studies also reported the association between xerosis with zinc or essential fatty acid deficiency, renal disorders, hypothyroidism, neurologic disorders that decrease sweating, HIV, malignancies, obstructive biliary disease, and individual with radiation therapy (18, 19). Previous study presented that essential fatty acid deficiency might correlate with pruritus and evening primrose oil which is an enriched nutrient in gamma-linolenic acid, a precursor of anti-inflammatory prostaglandin E1, at dose 2 grams daily for 6 weeks significantly improved pruritus uremic symptoms in terms less inflammation (20).

2.1.3.1 Function of the skin: Barrier function

Stratum corneum (SC) generates defense function in against the skin damage from the environment in two main mechanisms 1.to restrict excessive fluid loss through the epidermis and 2. to shield the external materials from the environment penetrate the skin layers including stimulate an immune response.

2.1.3.2 Composition of the skin on the epidermis

Anatomy of human skin provide in three layers: The epidermis, uppermost layer consists majority of keratinocytes that full of keratin protein in the cell include melanocytes cells, Langerhans cells, and Merkel cells. The basal keratinocytes at the lowermost of the epidermis transfer to the superficial by a mitotic activity in linear differentiation replace the dead keratinocyte at the upper (Figure2.1) (21). Hemidesmosomes connect between keratinocyte at base and basal membrane, while desmosome function by connecting the adjacent cell. The thickness of the epidermis is 100–150 μm. Another skin layer in the middle layer is the dermis, and the deeper layer is the subcutaneous tissue layer. In epidermis provide the major function in barrier against foreign substance and protect TEWL. The layers of epidermis divided compose of the stratum basale (SB), stratum spinosum (SS), stratum granulosum (SG), and stratum corneum (SC) (Figure 2.2).

(1) The stratum basale (SB)/ basal cell layer

The stratum basal layer is one layer that settles of epidermal stem cells. The junction between each cell in this layer as shown in Figure 2.3, desmosomes for attachment between cell and cell, gap junctions for intercellular cell connection allowing the passage of ions between cells, and hemidesmosomes for conjunction with the extracellular matrix and basal membrane. Hemidesmosomes and desmosomes are structural to form a rigid cellular cytoskeleton by cytokeratins (keratin filaments, tonofilaments) at the periphery of epidermal keratinocytes.

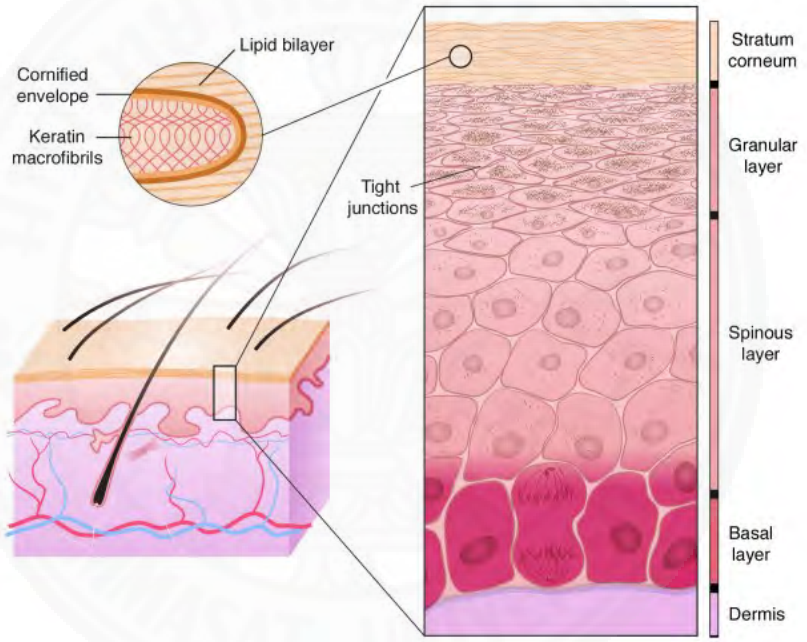


Figure 2.1 Linear differentiation stage of the epidermis transfer from the lower to the upper (22)

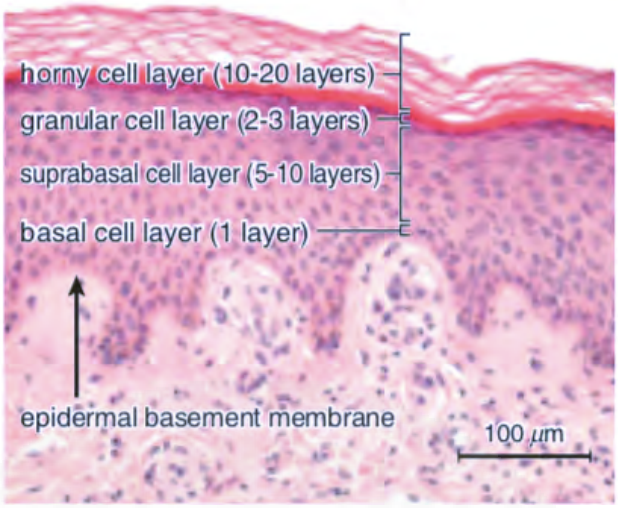


Figure 2.2 Demonstrated the pathology of anatomy layers of the epidermis (23)

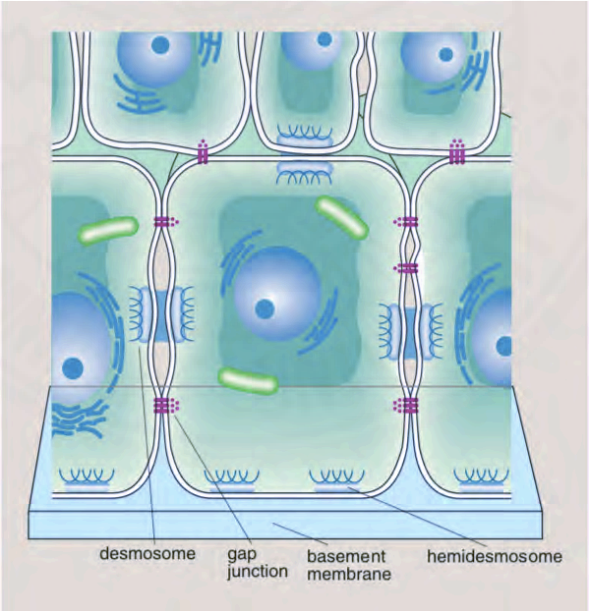


Figure 2.3 Intracellular junction between cell; desmosomes, gap junction and hemidesmosomes (23)

(2) The stratum spinosum (SS)/ suprabasal cell layer

The stratum spinosum layer consists of 5 -10 layers connecting each other with spiny appearance structures. Cells in this layer are polygonal shapes in the lower and more flatten in the upper. The size of cells in this layer has larger than basal cells (23).

(3) The stratum granulosum (SG)/ granular cell layer

The stratum granulosum layer is composed of 2-3 layers containing basophilic keratohyalin granules. The keratohyalin granules which releasing into the intercellular space as the intercellular lipid in stratum corneum. These granules which compose of keratins, profilaggrin, and loricrin and other proteins form the cornified envelopes playing an important function for reserve the water in the skin cells. Size of granular cell layer is flatter than the suprabasal cell layer (23).

(4) The stratum corneum (SC)/ horny cell layer

The stratum corneum which the uppermost layer of the skin. Cornified envelopes are the terminated product with envelope the outer membrane in SC called the cornification process. Also, the cross-linked proteins and ceramides in CE produce an effective barricade around the SC cell. The specific site of very thicker in The SC layer is the palms and soles (23). The majors structural of SC compose of natural moisturizing factor (NMF) containing keratin corneocytes, corneodesmosomes (protein interconnect between corneocyte together), and lipid lamellar forming like the brick and mortar (SC- brick and mortar structures modifier, Figure 2.4). The gross anatomy SC structural organization represents like a brick and mortar wall with a new considered to be thickness polyproteinaceous with lipid lamellar structure. In this model, "bricks" are like NMF containing the corneocytes fill in the SC wall and "mortar" is the intercellular lamellar lipid membranes which preserve the tissue stability. The SC lipid majority components consist of 50%ceramides, 20%fatty acids, and 25%cholesterol. Corneodesmosomes inter-connected between the bricks to ensure maximum structural durability. Filaggrin and its degradation products compact keratin and provide hydration and mobility sequentially (23-26).

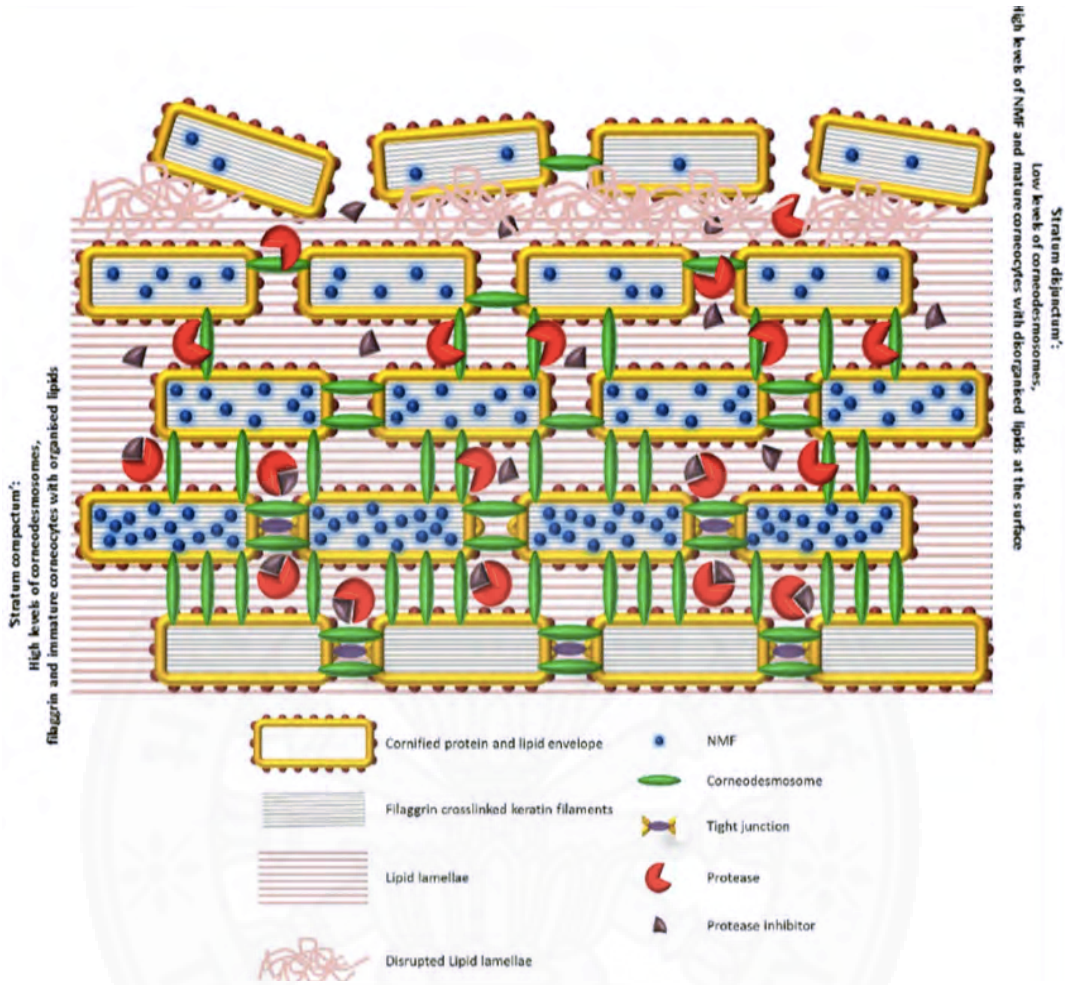


Figure 2.4 "Bricks and mortar" structures of the stratum corneum modified from Rawlings (26)

2.1.3.3 The cornified envelope

When the keratinocytes differentiation and desquamation, it transformed into the flatten and anucleated cell. These transformed cells are corneocytes, which compacted with keratin and covered by a lipid envelope calling a cornified envelope (CE). The CE is the external multilayered compartment of skin that terminal differentiates by increased transglutaminase-mediated protein cross-links and increased corneocyte envelope-lipid covering in the periphery of corneocyte. The protein envelope sealed the corneocyte at the inner surface of the corneocyte cell whereas the lipid envelope sealed the corneocyte at the outer surface as shown in figure 2.5.

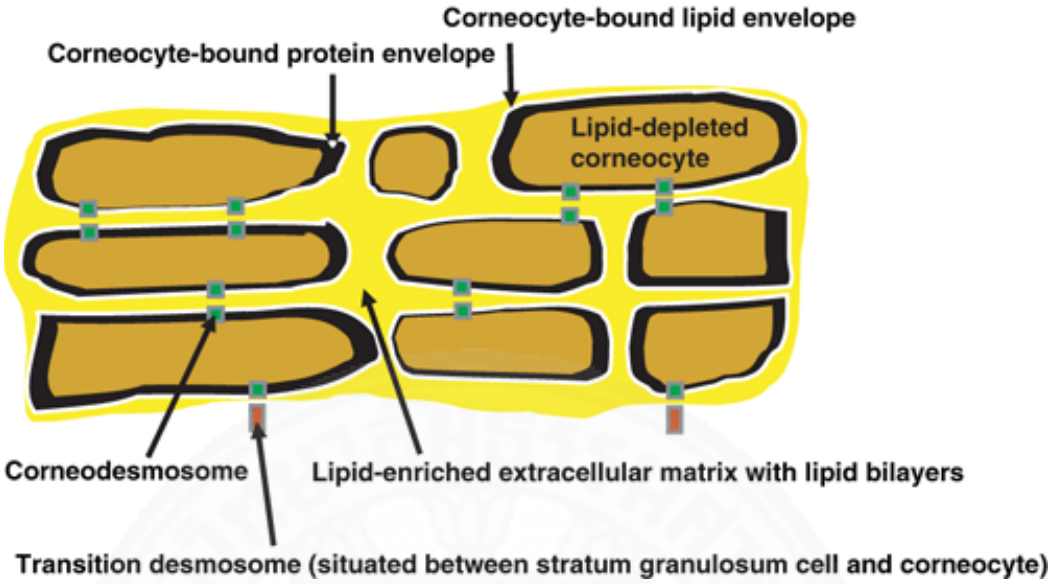


Figure 2.5 The corneocyte is sealed by an inner protein envelope and an outer lipid envelope (27)

It is essential in the functioning of the epidermal barrier. Role of CE as a 1. Directly barrier against pathogens penetration, as a 2. antioxidative stress in mechanic and chemical stress (27), as a 3. catalyzing membrane from the environmental molecules, come in, as a 4. UV radiation prevention, and as a 5.predominate organ for controlling excessive water loss(transepidermal water loss) (28). Candi et al., 2005 (29) reviewed mechanism epidermal differentiation and synthesis CE (Figure 2.6) by basal keratinocytes migrating from the basal layer initiate stage start in the spinous layer by generating cornified-envelope structural proteins with transglutaminase (TG)1 and TG5 crosslink envoplakin and periplakin under the cell membrane and attach with desmosome. In the second stage, reinforcement occurs in the granular layer, the process attachment of lipids to the cornified-envelope proteins, and crosslink loricrin, small proline-rich proteins (SPRs) by TG3 and TG1.

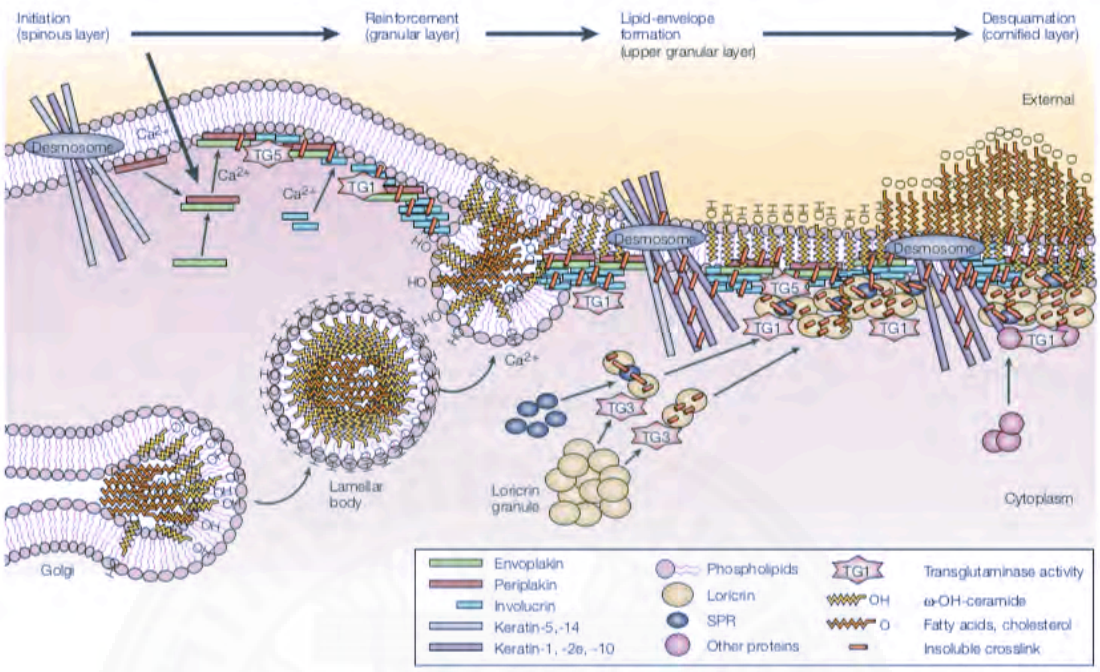


Figure 2.6 Terminal differentiation and the formation of the cornified envelope (29)

In the third stage, lipid-envelope formation occurs at the upper granular layer. Lipid lamellar form and crosslinked by TG5, TG1, and proteins (envoplakin, periplakin, involucrin). In reinforcement and lipid-envelope-formation stage occurs simultaneously. The desquamation phase, which in the last stage occurs in the cornified layer crosslinking of loricrin and other proteins by TG1 and the extrusion of ω-hydroxyceramides, fatty acids, and cholesterol. The cornified envelop expression components of specific proteins show in Table 2.1. The cornified cell lipid envelope consists of two parts:

(1) Protein envelope

The protein envelope of the CE including involucrin, loricrin, trichohyalin contributes to the biological consequence. Small proline-rich proteins (SPRs), are crosslinked by several transglutaminase (TGs) to accumulate the cornified envelope augmentation. At the molecular, the proteins that are formed cornified envelope and expressed in the epidermis are shown in Table 2.1 (29).

Table 2.1 Construction of amino acids and proteins in the cornified (29)

Cornified-envelope protein[‡]	% Gly	% Ser	% Lys	% Gln	% Pro	% protein found in the epidermis	% protein found in the forestomach
Loricrin[§]	59.4	24.1	2.0	3.4	1.8	82	65
Keratins	23.8	13.9	4.8	12.7	0.8	ND	10
Filaggrin	15.7	19.8	0.0	21.4	2.8	6	5
Involucrin	5.0	3.2	7.7	25.6	9.1	ND	ND
SPRs[§]	0.4	3.8	12.4	21.6	43.6	8	18
Overall amino-acid composition of the cornified envelope	50.3	21.8	3.4	5.9	5.1		

*Composition is expressed as % in w/w. ‡The most abundant amino acids in the cornified envelope are Gly, Ser, Lys, Gln and Pro residues. The unusually high content of these residues implies the lack of ordered structure (Gly, Ser, Pro) and the ability to function as a substrates for transglutaminases (Gln, Lys). §It is interesting to note that 83.5% of loricrin is composed of Gly and Ser and 77.6% of SPRs is composed of Lys, Gln and Pro. ND, not determined; SPRs, small proline-rich proteins.

Transglutaminase defect showed an impairment of SC stability sample in transglutaminase 1-deficient in mice's impact on mice's baby demise because of severe dehydration from the skin. In transglutaminase1 mutation in humans cause lamellar ichthyosis (30). Loricrin mutation has been found in Vohwinkel syndrome, mutilating keratoderma with ichthyosis from elasticity defect (30). Additionally, defection in a premature expression of involucrin, depletion of loricrin and filaggrin which is a precursor profilaggrin important for moisture of skin express in barrier dysfunction (27, 32).

(2) Lipid envelope

Lipid envelope, the outermost layer of corneocyte is a plasma membrane-like structure that plays a role in coating corneocyte cells and tightening the connection between intercellular lipid lamellar. Most of the major lipids of SC composed of cholesterol, free fatty acids, and ceramides. The ceramides are amide-linked fatty acids in the sphingoid base that have a function in the water balance maintenance in the stratum corneum by retraining water (27, 28).

2.2 Skin aging

2.2.1 Structural changes in aged skin

Farage et al. interested in chronologic aging and defined the degenerative change in aging skin can affect the structural skin in the deepness diameter and other components of the epidermis and dermis in the skin that described below (Figure 2.7.and Table 2.2) (34).

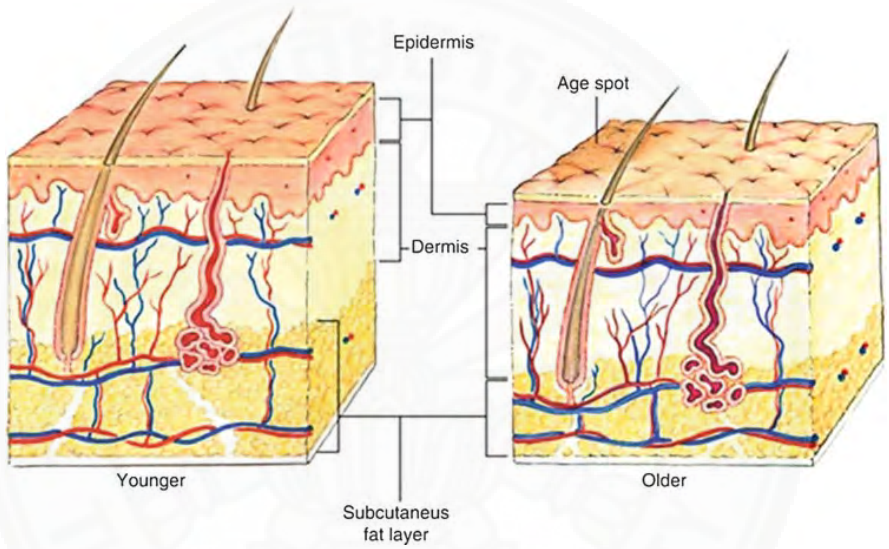


Figure 2.7 Comparation in skin structure between young and aged skin – Farage et al. (34, 35)

Table 2.2 Changes in the structure of aged skin (34)

	Effect of aging
Epidermis	Lower lipid component Flattened dermoepidermal junction Fewer active melanocyte cells by decreasing 8–20 % when increasing each ten years Fewer number of Langerhans cells Lower in renewal epithelization rate Elevation number of pores

Table 2.2 Changes in the structure of aged skin (34) (Cont.)

	Effect of aging
Dermis	Atrophy(loss of volume) Decreased blood vessels and cells Fewer collagen and fibroblast synthesis Degraded nerve endings sensation: Pacinian and Meissner's corpuscles Declined nerve ending cells Distorted structure of sweat glands, reduction functional of sweat glands Minimized elastic fibers
Hypodermis	Depleted subcutaneous fat Hypodermis volume decreases
Appendage	Depigmented hair Loss of hair Thinned hair Fewer number of sweat glands Fewer sebum production Abnormal nail plates

2.2.2 Physiological changes in aged skin

The degenerative change in aging that affect physiological changes discuss in Table2.3 (6, 34) include 1.)Biochemical changes; aged skin depletes vitamin D synthesis because it synthesizes immediately through the dermis and epidermis. When the ultraviolet radiation to the skin, the biosynthetic precursor, 7-dehydrocholesterol in stratum granulosum will metabolite to active vitamin D or calcitriol. As well as the higher skin pH of skin when aging especially striking in lower limbs which low circulation area different from the younger who have pH5.5. 2.)Permeability; the dehydration skin from aging impair penetration function and transit of permeants to the skin as a result of the transition materials depend on stratum

corneum and microcirculation. The compound hydrophobic or hydrophilic substance associated with penetration like the hydrophobic compounds penetrate easily in an lipids abundance. As well as the aged skin is dry, it less percutaneous absorption with hydrophilic chemistry. 3.)vascularization and thermoregulation; the capillaries and small blood vessels structure in elder skin become more distort and the number of blood vessel density declines. The decreasing function in eccrine sweating combines with decreasing dilation and constriction of blood vessels in dermal tissue in elderly physiology predisposing elderly hypothermia and heatstroke 4.) inflammatory response weaken due to keratinocytes- attended cytokine and mediators decreasing as well endothelial response dwindle (6). repair wound healing; epidermal turnover rate decrease around 30%–50% with age among the third and eighth decades, likewise renewal epithelization rate after wounding declines with age.

Table2.3 Changes in the function of aging skin (34)

Function	Change
Barrier function	Prolong epithelium replacement rate Declined % baseline TEWL in aging skin
Sensory and pain perception	Loss in sensitivity, especially after age 50 Itching sensitivity
Thermoregulation	Decrease sweat production
Response to injury	Declined inflammatory response Impaired wound healing Decreased reepithelization Increased vulnerability to mechanical trauma
Permeability	Fewer transdermal permeability Fewer sebum secretion Fewer vascular tissue Fewer metabolism rate

Table2.3 Changes in the function of aging skin (34) (Cont.)

Function	Change
Immune function	Reduced number of lymphocytes Poor response hypersensitivity reactions
Miscellaneous	Decreased vitamin D production Fewer elastin

2.2.3 Skin aging effect on the cornified envelope

During aging, both extrinsic aged as UV exposure, as well as intrinsic aging as the aging process influent to decrease reepithelization and affect to gene expression of CE in the epidermis. Therefore, the components of the cornified envelope were changed by

1. Downregulated Loricrin, the major component of the CE
2. Decreasing Filaggrin, the bundle keratins which is a function for the flattening of corneocytes and retaining water within epidermis (35)
3. Changing the epidermal calcium gradient in the stratum granulosum. Calcium is responsible for the differentiation of keratinocytes and expression of keratins 1 and 10, envoplakin, periplakin, involucrin, desmoplakin, corneodesmosome, desmoglein 1, transglutaminase 1. Calcium is necessary for the CE process and also be seen in several skin diseases: Darier disease, Hailey–Hailey disease, psoriasis, and atopic dermatitis (33, 35).

Consequently, the barrier function of the skin is impaired leading to an increased vulnerability to skin assault, decrease water retention in the stratum corneum, inhibits enzymatic activities. Including a decrease of the renewal rate of epidermal cells as a result of elderly skin has a longer renewal rate of epidermal cells

when compared with younger skin. The epithelial cells desquamation in elderly every 40–60 days whereas epithelial cells desquamation in young skin every 28 days (33).

2.2.4 Skin aging effect on epidermal water loss

The reservoir moisture of skin preventing epidermal water loss depends on the integrated structure of SC lipid; cholesterol, ceramides, and free fatty acids. The water retention in the skin is coordinate with the natural moisturizing factor which an important substance for water retention in the uppermost of SC and also depends on the normal desquamation process. The aging process contributes to the failure of water retention and tissue water loss, deficits in moist skin, and impair normal epithelization process. To summarize the skin aging effect on epidermal water loss and skin hydration by

1. Increasing the thickness of the stratum corneum for conceal evaporation of skin.
2. Flattening epidermal seen in general skin aging leads to serve epidermal water loss.
3. Decreasing total lipid structural by as much as 65 % of the aged skin.
4. Reducing ceramide levels, particularly ceramide 1 linoleate (15) and ceramide3 (34).
5. Reducing triglycerides of stratum corneum lipids (34).
6. Decreasing synthesis of “natural moisturizing factor” (NMF), which contains urea and degradation products of filaggrin and response for the water entrapment of the stratum corneum layer (37, 38).
7. Deficiency aquaporin-3 (AQP3) in older age over 60 years. AQP3 is a membrane passage channel controlling glycerol and water transport, regulation of glycerol concentration in SC for preserving skin hydration in human skin (39).

Consequently, the aged skin has low elasticity in stratum corneum and have the symptom of dry flaky, scaly skin, crack or fissure, dullness, and roughness skin surface include increased susceptibility defect of barrier function.

2.3 Xerosis in the aging

2.3.1 Etiology of xerosis in aging

The definite etiology of xerosis is multicomponent factors, there are intrinsic, genetic, environmental predisposing factors, dermatologic diseases and systemic diseases explanations cause to this problem in aging.

Intrinsic predisposition

Pathophysiologic change in aged skin occurs in both dermis and epidermis contributing to xerosis.

1. Reduced hydration content
2. Reduced total lipids capacity
3. Increased corneocytes and increase size of it
4. Reduced size of sebaceous gland
5. Reduced size of sweat gland
6. Reduced vasculature

Genetic and race predisposition

Non-European ethnic groups**,** African ancestry and Ethiopian patients have genetic susceptibility to atopic dermatitis and Filaggrin 2 (FLG-2) loss-of-function mutations increasing skin barrier dysfunction (48). People who have brown-black skin color expressed dry skin whole body 3 times more often than people who have light skin such as in the Mediterranean skin color group (3).

Environmental predisposition

Dry skin may link with the environmental factors stimulating increase trans-epidermal water loss**.**

1. Dry humidity or cold climate (e.g., air conditioners environment, winter seasonal, desert settle)
2. Harsh cleansers
3. Hot water bathing
4. Drying agent such as skin powders (12)

Dermatologic conditions

Several dermatologic diseases associated with xerosis conditions.

- Eczema
    - Dermatologic skin disease like eczema has prone to dry skin more than normal skin. And Mekić et al. (3) discovered that people who have eczema probability to skin dryness in the local area greater than normal 2.5 times, and probability to skin dryness in the whole-body skin greater than normal 7 times.
- Atopic dermatitis
    - History of atopic dermatitis which commonly found a history of skin dryness, erythema patches, and history of pruritus during childhood or adolescence, associated with xerosis and increased severity of xerosis (4) .
- Seborrheic dermatitis
    - Seborrheic dermatitis has prone to generalized dry skin more than normal skin 1.38 times (3).

The dermatologic condition concurrent with skin dryness

Augustin, M. et al (1) discovered that skin dryness was significantly correlated with:

- Axillary dermatitis
- Atopic eczema
- Exsiccation eczema from cumulative irritant dermatitis
- Psoriasis
- Plantar warts
- Seborrheic dermatitis
- Atopic disposition when controlling for age and gender

Systemic conditions

- Diabetes
    - Diabetes also affects associated with generalized dry skin than normal skin around 1.22 times (3).

- Asthma
    - Asthma associated with generalized xerosis as well as atopic dermatitis due to filaggrin gene (FLG) mutation and had strong relation in men (3, 50)

- Renal disease with dialysis, zinc deficiency and essential fatty acids deficiency, thyroid disease, neurologic disorders with decreased sweating, HIV (human immunodeficiency virus), and malignancies (19). Incompatible with Mekić et al. study (3) did not found a correlation between renal disease, hypothyroidism, atopic (asthma, hay fever, or dust mite allergy), and xerosis.

Influence factors on the development of dry skin showed in (Table2.4). White-Chu et al. (12) summarized pathogenesis of age-related skin dryness as figure 2.8.

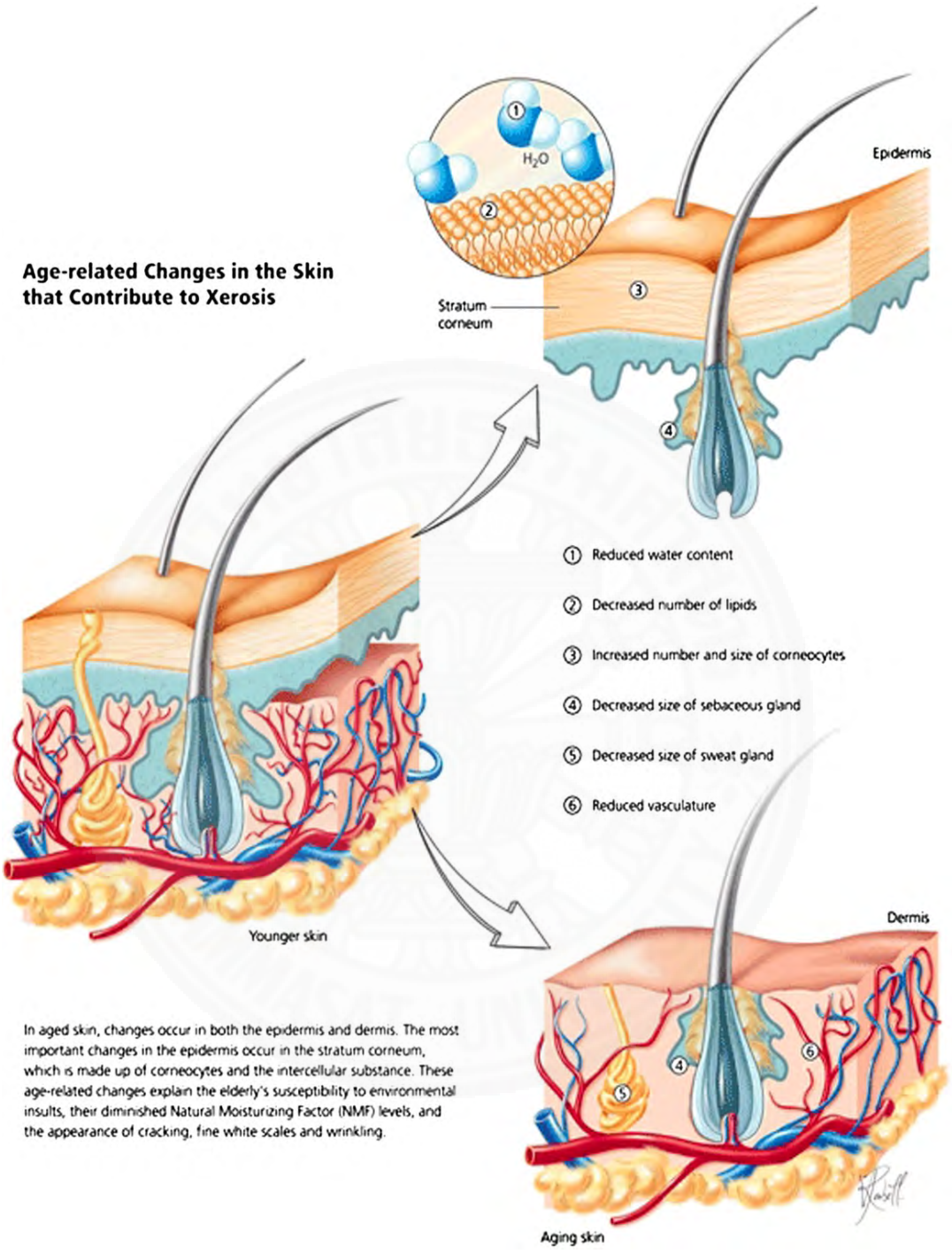


Figure 2.8 Aging skin changes contribute to xerosis (12)

2.3.2 Factors associated with xerosis and skin aging in the elderly

Skin aging includes two phenomena, 1. intrinsic aging in the aging process, hormone effect, and 2. extrinsic aging is commonly knowing in photoaging, reflecting of chronic sun exposure. The skin change that appear with aging relates to skin in dryness roughness and wrinkling. Xerosis or dry skin in old aged prone to more aggravating when older due to the pathophysiology of the elderly include decrease filaggrin production, alter lipid profile, and decrease moisture in the stratum corneum. In addition, xerosis is a dermatological condition which most commonly associated with pruritus in the elderly. There were a varied number of prevalence of epidemiological studies of skin dryness in the elderly who live in primary care and/ or in the nursing home showed in 30–75% (4, 13, 40). Paul et al. study defined the important risk factors associated with xerosis in the elderly were older age, female sex, dry skin or atopic dermatitis during childhood or adolescence, atopic dermatitis (current or previous) (4). The cross-sectional study in Rotterdam exploration for xerosis cutis in the middle-aged and elderly population was conducted in 2019 (3). It supported that factors significantly associated with dry skin in a general middle-aged and elderly population age were female sex, skin color, low body mass index, low outside temperature, eczema, certain medications like statins and diuretics, chemotherapy in the past. Person who apply moisturizing cream at face every day had significantly less localized dry skin. Owing to dry skin result from under various endogenous as well as exposure to the environment and exogenous conditions, the barrier is always damaged by an external force, and the hydration retaining mechanisms of the stratum corneum may be deprived. Matsui et al. study is interested in circadian rhythms controlled by the suprachiasmatic nucleus of hypothalamus affecting skin temperature, transepidermal water loss, and skin surface pH. TEWL is significantly higher in the afternoon and evening compared to the morning suggesting that higher TEWL in the evening lead to itching symptom at night of eczema patients. Highest moisture loss, highest skin blood flow at night of circadian rhythms (41).

Table2.4 Influence factors on the development of dry skin (37)

Inadequate hydration in the stratum corneum:

- Climates condition like as cold weather and low humidity, cool air room temperature, windy weather
- Hypothyroidism disease and uremia

Abnormal keratinization:

- Over epidermal proliferation such in psoriasis, ichthyosis, and atopic dermatitis
- Impair desquamation of corneocytes in old individuals

Inadequate lipid synthesis:

- Ichthyosis autosomal-recessive type
- Gaucher's disease in a severe with diminished glucocerebrosidase activity with downregulated glucocerebrosidase activity

Barrier damage:

- Irritants or organic solvents contact
- Regularly washing with soap
- Bacteria colonization

Table 2.5 Review risk factors associate xerosis in elderly beside aging process

Authors	Risk factors association xerosis	Skin assessment	Reference
Yoshimoto-Furuie K et al., Nephron. 1999	Essential fatty acids (EFAs) deficiency, (e.g. linoleic acid, γ-linolenic acid and arachidonic acid) aggravate uremic pruritus. - Oral supplementation with evening primrose oils (rich in γ-linolenic acid) at the dose (i.e., 2 g/day) significantly ($p > 0.05$) improved uremic pruritus than those given linoleic acid during the 6-week	-	(20)
Freiman A et al., CMAJ., 2004	Swimmers, long hot showers, long soaks in Jacuzzis and hot tubs (Dilution and melting of the natural protective skin sebum)	-	(42)
Lee D et al., AIDS. 2007	HIV- infected men, current indinavir use, CD4 cell count less than 200 cells/µl and recent opportunistic infections were associated with dry skin	Self-reported questionnaires	(43)
Paul C. et al., Dermatology, 2011	Age (OR: 1.48, 95% CI: 1.16–1.89), female sex (OR: 1.80, 95 CI%: 1.29–2.53), treatments that can potentially cause xerosis (OR: 2.21, 95 CI%: 1.54–3.17), itching during sweating (OR: 7.11, 95% CI: 3.90–12.95), a history of dry skin (OR: 2.89, 95% CI: 1.65–5.08) and a history of atopic dermatitis (OR: 3.60, 95% CI: 1.99–6.52)	Overall Dry Skin Score	(4)

Table 2.5 Review risk factors associate xerosis in elderly beside aging process (Cont.)

Authors	Risk factors association xerosis	Skin assessment	Reference
Danby SG.Curr Probl Dermatol., 2016	Repeated washing, harsh detergents and soap, synthetic detergents like SLS and alkyl carboxylates from traditional soaps increase the pH of the SC, winter months season	-	(44)
Makowski A et al., Textbook of aging skin, 2016	Skin alkalization, postmenopausal woman (low level of estrogen)	-	(45)
Iizaka, Archives of gerontology and geriatrics, 2017	Admitted to hospital in the past year (b=−9.4, P=0.008), frequency bathing habits (b=−4.6, P=0.014); defined as always or often, having an outdoor activities (b=−5.7, P = 0.007) were negatively associated stratum corneum hydration. - Diuretics (b = 11.5, P = 0.002), moisturizer use (lotion) (b = 4.6, P = 0.022) were positively associated with stratum corneum hydration.	VAS score, SC hydration device, self-administered questionnaire	(9)
Toncic, R. J et al, Clinics in dermatology, 2018	Decreased levels of estrogen in menopausal woman, sex (female> 40 yrs.) due to sebum content is mainly influenced by androgens, testosterone and dehydroepiandrosterone , incontinence-associated dermatitis due to overhydration and chemical (perianal, buttock, inner and posterior thigh) irritation from urine and/or stool, cleansing irritation,	-	(46)

Table 2.5 Review risk factors associate xerosis in elderly beside aging process (Cont.)

Authors	Risk factors association xerosis	Skin assessment	Reference
	malnutrition, psychological stress , hemodialysis patient, UV exposure	-	
A. Lichterfeld-Kottner et al., 2018	Sex (male), respiratory and cardiovascular diseases, pruritus, incontinence-associated dermatitis	Overall Dry Skin Score	(47)

2.3.3 Skin assessment for xerosis

2.3.3.1 Clinical history

The assessment should include patient's skin history with prone to xerosis are following:

- General health status of the patient
- Co-existing medical using that may be result skin dryness as retinol drug and lowering lipid drug
- Active dermatological disease such as eczema or psoriasis
- Allergic history of the patient
- Aggravating factors that have improved or deteriorate dryness symptom
- The patient's quality of life impact on their skin problem

2.3.3.2 Skin examination

(1) Clinical presentation of dry skin (xerosis)

Xerotic skin is dry and dull, with fine bran-like scales, if more advanced, the skin exhibits a crisscross pattern of fissures of the horny layer ("crazy-paving", eczema craquele, "dried riverbed") and appears pink to light red in color(49). Distribution of skin dryness spread to the thighs, proximal extremities and trunk. The lower extremities perform the most frequent area of dry skin. Another area such, feet and legs found 43-47% followed by the hands and arms 32% and trunk and face 24% consequently (2, 51).

Figure 2.9 Asteatotic eczema (eczema craquele) (49).The characteristics finding of xerotic skin described in obvious white scale and superficial cracks and fissures like crisscross pattern on lower extremities.

2.3.3.3 Tool assessment of xerosis

(1) visual skin assessment

1. Overall dry skin score (ODS)
2. Xerosis severity scale (XSS) presented by Rogers et al(15)

The Overall Dry Skin score is an easier scale assessment of the severity of skin dryness in an analog scale in a five-point score. A score of '0' means no skin dryness, whereas a score of '4' means advanced skin roughness, large scales, inflammation, and cracks. Accompany with the clinical scoring systems of European Group on Efficacy Measurement of Cosmetics and Other Topical Products (EEMCO) guidance adopted by Masson et al., 1995 suggest use ODS for assessment skin dryness by visual evaluation (recommended B) and interpret along anatomical region site. The Xerosis severity scale shows score and interpret results in Table 2.7.

Table 2.6 Overall Dry Skin score

Grading score	Description sign of dry skin
0	Absent
1	Faint scaling, faint roughness, and dull appearance
2	Small scales in combination with a few larger scales, slight roughness, and whitish appearance
3	Small and larger scales uniformly distributed, definite roughness, possibly slight redness, and possibly a few superficial cracks
4	Dominated by large scales, advanced roughness, redness present, eczematous changes, and cracks

Table 2.7 Xerosis severity scale (XSS)

Xerosis Severity Scale*

Severity	Rating	Description
Mild	0	Normal skin
	1	Dusty appearance, few minute skin flakes
	2	Generalized dusty appearance, many minute skin flakes
Moderate	3	Defined scaling with flat borders
	4	Well-defined heavy scaling with raised borders, shallow fissures
Severe	5	Large scale plates, fissures
	6	Large scale plates, deep erythematous fissures

*Adapted from Rogers et al.[10]

(2) Biophysical measurements of skin tissue

1. Tissue dielectric constant (TDC)

Measurements of tissue dielectric constant (TDC) of human skin at a frequency of 300 MH. It uses for assessment skin-tissue water to-fat tissue water on forearm skin. Besides, it's usefulness is assessing lymphedema in breast cancer, lymphedema after treatment (53, 54).

2. Transepidermal water loss (TEWL)

The device to access TEWL outcome is Tewameter. The result of TEWL calculated from the measurement water vapor pressure gradient on both sides. It evaluates the amount of water that passively evaporates through the barrier skin to the air environment (55). TEWL functions assessment of the physiologic barrier property of skin barrier. Skin diseases like psoriasis and atopic dermatitis including mechanical irritation from scrubbing, friction, abrasion, and chemical irritation from applications of solvents and detergents which defect or disturb skin barrier function increase TEWL value.

3. Skin hydration

Skin hydration or epidermal hydration was assessed by measuring the electrical capacitance of the probe, Corneometer CM 825- based instrument manufactured by Courage-Khazaka.

2.3.3.4 The measurement of TEWL

(1) The principle of the method

"Fick's diffusion law" principle is the physical formula law for a move from a region of high concentration to a region of low concentration explain in TEWL measurement function which common form is below;

$$J = -D\frac{d\varphi}{dx}$$

J is the diffusion flux, measuring the amount of substance that will flow through a unit area during a unit time interval.

D is the diffusion coefficient; Its dimension is area per unit time = (0.0877 g/m^2/h mmHg). It is proportional to the squared velocity of the diffusing particles, which depends on the temperature, viscosity of the fluid and the size of the particles according to the Stokes–Einstein equation (56).

φ (for ideal mixtures) is the concentration, of which the dimension is amount of substance per unit volume.

x is position, the dimension of which is length.

The tewameter has two pairs of sensors of the probe located

in different heights, temperature and humidity. The two sensors measure the gradient of water evaporation out of the skin (Figure 2.10) (57). Average TEWL in human is about 300–400 mL/day(59) which means 1/10th to 1/20th of sweating, maximal sweating values of 2–4 l/h. Device example is Courage & Khazaka Tewameter^{TM} TM 300 (Figure 2.11). Tewameter measure vapor pressure (VP) gradient at the skin surface between two distinct points. Placing in perpendicularly to the skin surface and prohibiting placing in horizontal to skin surfaces is suggested for correcting the position of the probe. As a result of air convection from the horizontal to skin surface effect interfere correctly reading.

Assessment TEWL can divided in two method 1. an open-chamber method and 2. closed-chamber method. The open-chamber are influenced by air convection. Because this method is open air to the surrounding atmosphere. Relative humidity is measured using capacitive sensors. The probe was considerately placed at an angle of 90° on the area measurement and then the program CK MPA Multi Probe. Adapter software will interpret and record the value. Example the Tewameter TM 300 measuring the level of TEWL as shown in figure 2.12.

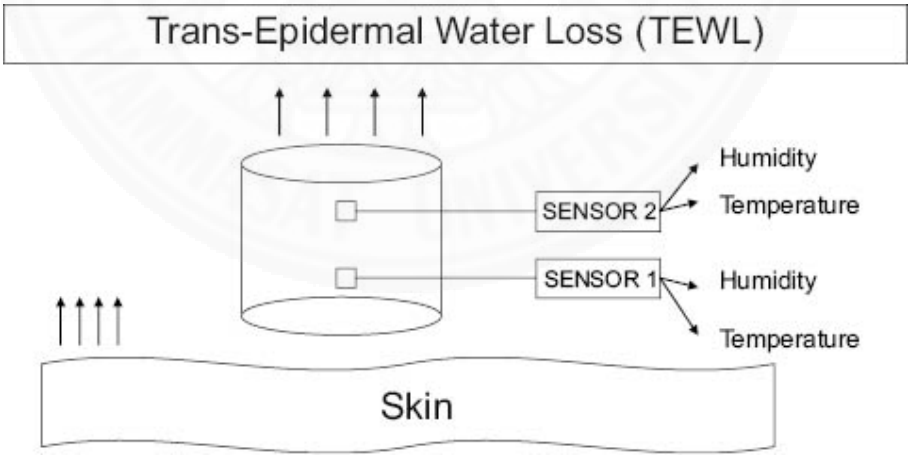


Figure 2.10 Trans-Epidermal Water Loss concept to measure by using two pairs of humidity and temperature sensors (57)

Figure 2.11 (A) Tewameter TM300 probe as part of the Cutometer MPA 580 (Courage & Khazaka GmbH, Cologne, Germany). (B) Tewameter sensors in probe head. (C) Probe positioning on the right lower arm. (55)

(2) TEWL measurement following EEMCO recommendation (59)

1. At least 15–30 minutes of acclimatization timing under temperature 20–22°C and relative humidity 40–60% before measuring TEWL.
2. Position of the probe measurement in horizontal plane.
3. Making measurements on the same anatomical position and continuously three constant measurements. Finding the result in an average range of those three measurements.
4. Recording measurements when reach a stable signal.
5. Recommended the one person making a device measurement to reduce variability.

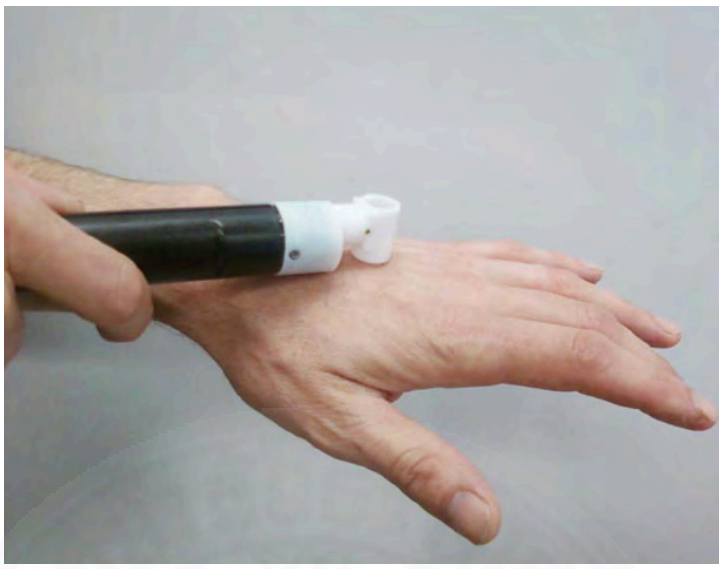


Figure 2.12 Measurement of TEWL using a Tewameter (60)

(3) Variable factor effect to assess TEWL

- Endogenous factors

1. The anatomical position site(s)

- Higher TEWL value founded at the skin sites with smaller corneocytes (58)

- Higher TEWL at U zone of the face more than T zone of the face due to the thinner lipid at U zone area and the pH levels changing toward alkaline at U zone than the thicker lipid at T zone area (61)

- Higher TEWL at the palms, soles, axillae, and forehead and lower at the calf and forearm (62)

2. Ethics; Black South African native has higher TEWL than Asian and Caucasian accordingly (62).

3. Skin disease; Higher TEWL discovered in keratinization disorder or barrier skin defect in burns, psoriasis, some ichthyotic disorders, contact dermatitis and atopic dermatitis (58)

4. Time of day when measurements; The circadian rhythms effect to the different result of TEWL value in different time in one day thus should be measured at the same time of day

- Exogenous factors

1. Cleansing, surfactant and organic solvent in soap product; increasing TEWL

2. Creams/ lotions; decrease TEWL

3. Caffeine drinking and smoking; Smoking influent TEWL increasing

- Environmental factor

1. Ambient workplace temperature; Lower TEWL will be measured because of the drop of water vapor pressure gradient in the high humidity area.

- Experimental and measurement/instrumentation factors

1. The type of instrument production along of different manufacturer.

2. Equilibration time of instrument to the measurement of device both TEWL and skin hydration instrument.

3. Calibration of the device of individual instruments manufacturer and former to use.

4. Repetition of probe calibration to check during the study.

5. Acclimatization control under EEMCO guidance before measurement study; duration, ambient temperature, and RH. Following the manufacturer instructions about the application of a machine to the skin surface, handling of the device probe and time to calibrate a stable measurement.

6. The number of analyses of each anatomical region and interval time between measurements.

2.3.3.5 The measurement of skin hydration

(1) The principle of the method (Figure 2.13)

1. Corneometer tests the hydration of the skin, when the stratum corneum increase hydration, dielectric capacitance will increase. It reads a value from the difference between the dielectric constant of water and those substances (63).

2. The depth ability measurement is 10-20 μm of the stratum corneum depth (64).

3. Interpret the values of skin hydration is between 0-130 arbitrary units (AU).Variation value in anatomical position site example the middle area of the front side of the forearm are the following: under 30 AU – very dry, between 30 and 45 AU – dry, 45 AU – sufficiently hydrated.

(2) Skin hydration assessment following EEMCO recommendation (61) :

1. Standard working conditions under controlled T = 20-22°C, humidity 40-60 %

2. Interval time of each sequential measurement is 5 seconds between continuous skin hydration measurements on the same anatomical position.

3. Avoiding body hair area for skin hydration measurements cause of interfere with the contact sensor and the skin

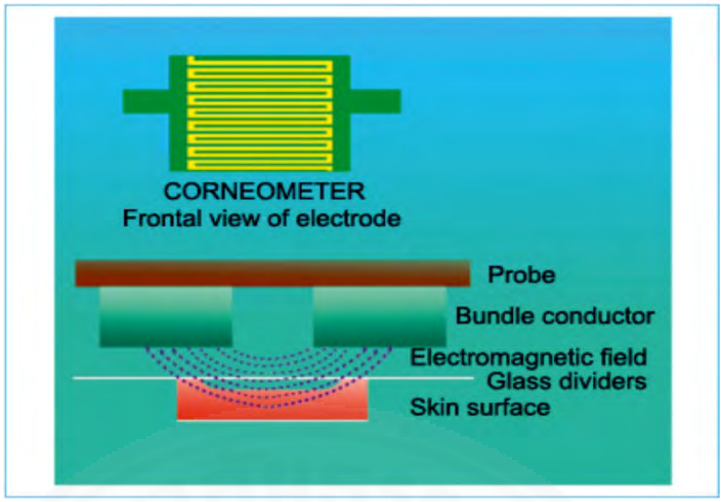


Figure 2.13 Principle of the corneometer CM from instruction Corneometer® CM 825 (63)

Figure 2.14 The hydration measuring probes of Corneometer (63)

(3) Variable factor effect to assess skin hydration (59) :

Similar as TEWL;

- Endogenous factors; Anatomical position and anatomical site to measurement, timing of the day.
- Exogenous factors;

1. Consequence of washing; Increasing risk of solvents and detergents product irritable skin and disturb intracellular lipids and protein result to decrease skin moisture.
2. Topical products, occlusive; The application of any topical cream/ lotion at the site to measurement should be avoided at least 12 hours before measurement.
3. Chemical and textile exposure from occupational industry at skin area to measurement.
4. Caffeine drinking or smoking before.

- Environment; climate and season
- Experimental and measurement/instrumentation factors; similar as TEWL. For skin hydration continuous measurement was advised to waiting for 5 seconds on the same site.

Available commercially skin hydration instruments of manufactures are noted in Table 2.8.

Table 2.8 Available commercially skin hydration instruments of manufactures (59)

Instrument	Measurement principle	Manufacturer
ASA-M2	Conductance	Asahi Biomed Company Ltd, Yokohama, Japan
Corneometer CM820 and 825	Capacitance	Courage & Khazaka, Cologne, Germany
Dermalab Moisture Unit	Impedance	Cortex Technology, Hadsund, Denmark
Moisture Meter SC	Capacitance	Delfin Technologies, Kuopio, Finland
Nova Dermal Phase Meter DPM 9003	Impedance	Nova Technology Corporation, Portsmouth, NH, USA
Skicon 200 and 200 EX	Conductance	ISBS Co Ltd, Hamamatsu, Japan

2.4 Management of xerosis

Management of xerosis is to maintain epidermal barrier function, to protect infection and physical damage. To achieve goal of xerosis should following:

1.) Topical moisturizers are benefit in managing xerosis for improvement skin hydration and humidity skin barrier. Moisturizing products achieve their moisture barrier properties. Basic active ingredients of moisturizing products separated in main classed as occlusives, humectants, emollients or rejuvenators (65).

2.) Keratolytic agent: studies demonstrated that the benefit keratolytic was useful in reducing xerosis clinical features in terms of decreasing roughness, scaling, fissure, thickening of the skin. The example keratolytic agents are 40% urea cream, 12% ammonium lactate lotion (66-68). However, a sensitive skin person may be stinging and irritation form -hydroxy acid formulation.

3.) Applying low- high potency corticosteroids was suggested in moderate to severe.

cases skin dryness.

4.) Anti-pruritics should be added if xerosis associated with pruritus.

Additional advice management dry skin include (13):

- Diminish the regularity of bathing and avoidance of hot bathing.
- Avoid using soap and prefer using a no irritable soap.
- Gentle cleansers using, avoid scrub or irritable skin cleansers.
- Moisturizers using
- Withdraw friction, wearing loose and smooth clothing.
- Use a steamer in the dry room.

2.4.1 Types of moisturizers

Occlusives

Occlusives are the most effective moisturize skin moist by decreasing TEWL 99%. Their responsibilities are a hydrophobic coating on the skin surface protecting of dehydration of the skin. Illustration occlusive moisturizer show in Table 2.9 (65).

Humectants

Humectants improve the water reservoir from the dermis into the epidermis. They increase the water status of the skin are the result of hydrating the stratum corneum. Some described that humectants can absorb water from the external environment to hydrate the stratum corneum. Humectants and occlusives always merge ingredients of moisturizer formula for increasing the effectiveness of barrier dehydration of dermis to the external environment that lower humidity. Humectants substances such as hydroxy acids, propylene glycol, glycerin, and urea show in Table 2.9. Glycerol or glycerin stimulates transglutaminase activity which necessary in the cornified envelop formation process enhancing the stability of stratum corneum and lessening flaking in xerotic skin. Glycerin is also the ability to produce moisturizing effects with aquaporin-3 water channels in the epidermis with decrease transepidermal water loss in skin disease (65, 69).

Emollients

Emollients function by filling the gaps between corneocytes, improving the appearance and softening, and smoothing skin texture feeling. For example, the emollients such as Petrolatum, vegetable oil, dimethicone, propylene glycol and castor oil show in Table 2.9 (65).

Rejuvenators

Rejuvenators restored vital proteins in this skin like collagen, keratin, and elastin in the dermis. They have comparatively function as emollients for aesthetically smoothen the skin (65).

Ceramides

Ceramides are lipid molecules which a vital component of stratum corneum, not a divided in class of moisturizer. In recent years ceramides are used to add in many moisturizes cosmeceuticals because its property help maintain the stability of the skin barrier. Moreover, it reputatively moisturizer ingredients in cosmeceuticals products for the treatment of atopic dermatitis and normal skin (65).

Table 2.9 Illustration of active ingredients moisturizer in broadly individual categories (70)

Humectants	Occlusives	Emollients	Rejuvenators
Glycerin	Lanolin	Petrolatum	Collagen
Urea	Paraffin	Vegetable oil	Keratin
Ammonium lactate	Petrolatum	Dimethicone	Elastin
Gelatin	Cholesterol	Propylene glycol	
Hyaluronic acid	Stearyl alcohol	Castor oil	

Table 2.10 Clinical Practice Guidelines, Consensus Statements and recommendations for treatment of dry Skin

Authors	Topic	Recommendations of Skin Care
Holden et al.(2002) (71)	Regarding the practice for use of emollients against dry skin conditions	(1)Avoid showering and bathing with soap instead use emollient soap for dry skin (2) Apply emollients lotion/cream no less than two times a day in volume 500 g or more per week and (3) ABC solution for A-avoid soap, B-benefit from emollients, C-control inflammation
LeBlanc and Baranowski (2011) (72)	The prevention of skin tears	(1) Not hot bathing; (2) pH-neutral cleanser, free-foam soap /without saponification; (3) application hypoallergenic moisturizer twice per day; (4) application of moisturizers after showering while skin is still moist; and (5) limit frequency bathing
Guenther et al. (2012)(73)	Prevention and treatment of dry skin	1) Limit timing bathing five minutes; (2) soapless soap using; (3) limit soap, cleansers, and shampoo; (4) wear loose cotton clothing; (5) limit sun exposure; (6) use of botanical and perfume-free products; (7) apply moisturizers; (8) use of occlusion moisturizer cream for hands and feet; and (9) gentle dapping for skin dry (avoid rubbing or harsh toweling)

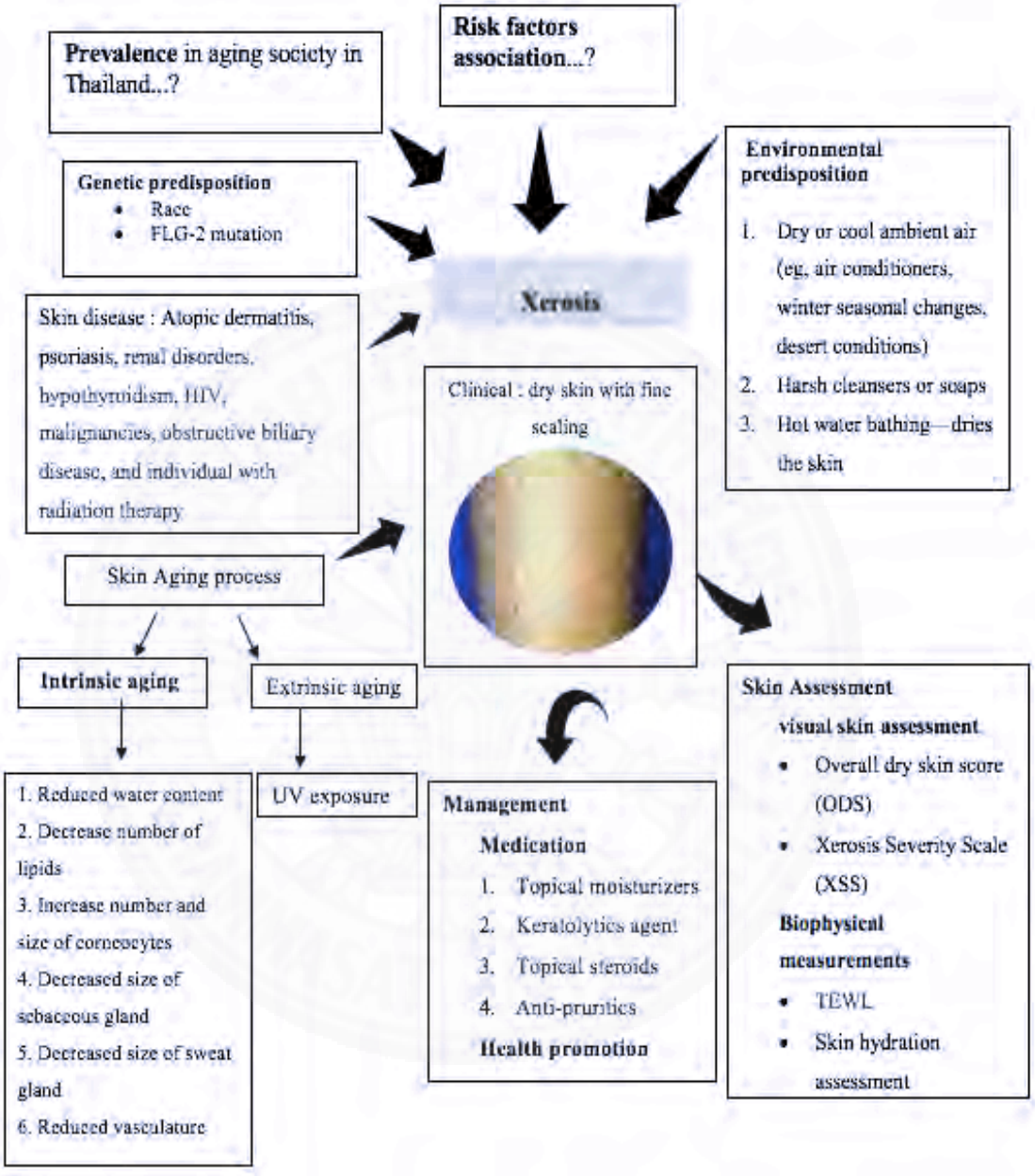
Table 2.10 Clinical Practice Guidelines, Consensus Statements and recommendations for treatment of dry Skin (Cont.)

Authors	Topic	Recommendations of Skin Care
Ananthapadmanabhan et al. (2013) (74)	Daily cleansing—caring for healthy stratum corneum	(1)Gentle cleanser with anionic include acyl phosphates, acyl sarosinates, acyl taurates, sulphoacetates and isethionates; (2) application of anionic surfactants with amphoteric and nonionic surfactants reduce irritation potential; and (3) use of products with pH 6.5
Moncrieff et al. (2013) (75)	Consensus statement for the use of emollients in dry skin conditions	1)Using emollients including leave-on products, washing products, and bath emollients according to skin condition; (2) aqueous cream is damaging the skin barrier; (3) emollients have anti-inflammatory properties; (4) all products used on skin should be emollient based; (5) use of soaps and detergents should be avoided; (6) application of emollient several times a day; and (7) humectant-containing products lead to greater barrier repair

Table 2.10 Clinical Practice Guidelines, Consensus Statements and recommendations for treatment of dry Skin (Cont.)

Authors	Topic	Recommendations of Skin Care
Humbert, Philippe, et al. (2016)(76)	managing cutaneous disorders associated with advancing age	(1) Daily skin care with gentle cleansers: Ideally with an emollient, avoid scrub when washing or drying (2) Suggestion using emollient therapy containing humectants and skin lipid replacement agents for xerosis pruritus (3) Suggestion using ingredients enhancing hyaluronic acid synthesis, softening brittle skin for promoting healing for skin tearing

2.5 Conceptual Framework



CHAPTER 3
OBJECTIVES

3.1 Research questions

(1) What is the prevalence of xerosis in middle-aged and elderly in Thai people?

(2) What are associated factors in skin dryness in middle-aged and elderly in Thai people?

3.2 Specific objectives

Primary objectives:

The aim of this study was to measure the prevalence of xerosis in middle-aged and elderly in Thai people.

Secondary objectives:

To determine demographic health characteristics associated with the severity of skin dryness in middle age (age 45-65 yrs.) - elderly(age>65 yrs.)

CHAPTER 4
SIGNIFICANCE OF THE RESEARCH

In aging process, the strength of the skin hydration was loss and normal desquamation was impaired. Due to structural change in aging process; flattening epidermal, decreasing intercellular lipids and free fatty acid in SC, decreasing synthesis of “natural moisturizing factor” (NMF), decreasing ceremide level consequently impair effective barrier function and SC hydration. Xeronic, or dry skin presents clinical feature of cracking, scaling, skin roughness and may presents pruritus symptom. It plays multiplex multifactorial involvement and still is underlying dermatologic and systemic disease.

Nowadays xerosis seems to be common problem in aging worldwide. It might be effect of pathophysiology of advance age and others risk factors. Study in Asian about prevalence of xerosis starting middle-aged to elderly in general population, still little searching. Thus, we interest finding the number of xerosis and furthermore searching the association factors that influence on xerosis in this group in Thai people. We hope this study will realize the Thai healthcare professionals and skin care persons about the xerosis number situation of pre-geriatrics and geriatrics in Thai. To identify the possible factors, relate with xerosis or xerosis intensity for suggestion the general to avoid those risks.

CHAPTER 5
RESEARCH METHODOLOGY

5.1 Study sample

5.1.1 Target population

An observational, cross-sectional study in persons age 45 or older defined between about 45 and 65 years for middle-aged and aged 65 or older defined for the elderly were enrolled. Aging who age 45 or older were asked to voluntarily take part in the prevalence and risk factor surveys. The purpose and method of the study was informed to all participants. The information sheet was given, and consent forms were done before they enrolled in the study.

5.1.2 Sample size

The study was conducted in a sample in general Thai people who is over the age of 45 years. Sample size were calculated in the formula. (3)

$$N = \frac{X^2_{\alpha/2}\ p\ q}{d^2} = 113.83$$

X = Z score of normal distribution = 0.1	p = population= 0.6 [3]
q = 1-p	α = 0.05 for statistics significant
d = errors =15%	

Sample size (N) = 114 is requirement

5.1.3 Inclusion criteria

- Male or female who age over 45 years old.
- Fitzpatrick skin Types III to V

5.1.4 Exclusion criteria

- Active skin disease e.g. eczema, psoriasis, inflammatory skin disease at the site of skin measurement

5.1.5 Discontinuation criteria

- The participants refused to enroll in the study

5.2 Research design

Cross-sectional observational study; prevalence and association risk factors of xerosis in general people who age 45 or older study at the dermatology outpatient clinic of Benjakitti Park Hospital.

5.3 Materials and method

5.3.1 Data collection

The studies were performed on a separate day in 2019, December 18Th, and 2019, December 23 Th. The middle-aged and elderly in Thai people at Benjakitti Park Hospital who age > 45 years were invited to participate. On a specific day, data collection was performed. The data collected from questionnaires in google forms based on a standardized data collection form. The questionnaire related to their personal history and family history, the history of atopic conditions (current and past) such as asthma, allergic rhinitis, allergic conjunctivitis, and atopic dermatitis, information about demographic data (age, gender, socio-occupational category before retirement), concomitant diseases (eczema, seborrheic dermatitis, diabetes mellitus, renal failure, and others). Eczema was defined as erythematous, scaly, excoriated, lichenified, fissured patches. Seborrheic dermatitis was defined as erythema with

greasy scaling on the scalp, face, or chest. The data still collected the skincare knowledge part, their life habits; including tobacco smoking, alcohol drinking, hydration, personal hygiene, living environment, cosmetic agents containing soaps or detergents and perfumes, the use of emollients and/or moisturizing; current/prior treatment with retinoids, or lipid-lowering drugs, climatic conditions and information related to sun exposure. All about the data were collected by a self-answer questionnaire under the guide of trained dermatologist medical. Clinical assessment of xerosis was performed by visual examination using the Overall Dry Skin (ODS) score according to the guidelines of the European Group on Efficacy Measurement of Cosmetics and Other Topical Products (77) and xerosis severity scale (XSS). Device assessment, we used tewameter and corneometer evaluated TEWL and skin hydration accordingly at the anterior aspect of the tibia on the left leg site by the same dermatologist training.

5.3.2 Preparation of research subjects

1. Details in the information sheet will be informed to all subject.
2. Subjects will be selected to enroll in the study will be informed
   a. To avoid use any topical products (cosmetics, lotions, barrier creams, etc.) above the site that measurement before evaluation for 24 hours (78)
   b. To avoid soap while bathing, powder at the site that measurement before evaluation for 24 hours (78).

5.3.3 Outcome measurement

1. Patients' demographic data and prevalence of aging in Thai (persons who age in middle-age to elderly)
2. Association risk factor for xerosis in aging
3. Dermatology Life Quality Index (DLQI) questionnaire
4. Subjective measurements ; Visual skin assessment
   a. Overall Dry Skin score (OD
   b. Xerosis severity scale (XSS)

- According to the guidelines of the EEMCO, the Overall Dry Skin (ODS) score (52) defined grading score of ODS; 0 = absent dry skin, 1 = faint scaling, faint roughness, and dull appearance, 2 = small scales in combination with a few larger scales, slight roughness, and whitish appearance, 3 = small and larger scales uniformly distributed, definite roughness, possibly slight redness, and possibly a few superficial cracks describe, 4 = dominated by large scales, advanced roughness, redness present, eczematous changes, and cracks.

- Define grading score of XSS (79); severity mild score 0-2; 0 meaning normal skin, 1 meaning dusty appearance, few skin flakes, 2 generalized dusty appearance, many skin flakes; severity moderate score 3-4; 3 meaning defined scaling with flat borders, 4 meaning well-defined heavy scaling with raised borders, shallow fissures; severity severe 5-6; 5 meaning large scale plates, fissures, 6 meaning large scale plates, deep erythema fissures.

5. Objective measurements: Biophysical skin parameter assessment

Each measurement was acclimatized in a setting room temperature according EEMCO recommendation

a. Transepidermal water loss (TEWL) measurement

i. TEWL was a recorder device for estimate water evaporates from the skin. Suggested 3 measurements at any test site.

ii. TEWL was measured with the stable time (average 1 min) on the skin .The record units were displayed in g per m^2 per h. (79)

iii. Based on the instructions of Courage and Khazaka, the results were interpreted as follows: (in g/hm2) 0–10 very healthy skin, 10–15 healthy skin, 15–25 normal skin, 25–30 stressed skin, >30 critical skin

iv. TEWL > 25 was reference value to describe the skin dryness in participants

b. Corneometer (CM) for SC hydration measurement

Based on the instructions of Courage and Khazaka, digital sensor technology of the Corneometer CM 825, the results were interpreted as Table5.1

Table 5.1 Interpret result of corneometer**

	forehead, t-zone, scalp, cheek, eyelid, temple, corner of the mouth, upper body parts, back, neck	arms, hand, legs, elbows
very dry	< 50	< 35
dry	50 - 60	35-50
sufficiently moistured	> 60	> 50

**(80) (81)

- CM < 50 was reference value to describe the skin dryness for legs skin in participants

5.4 Statistical Analysis

Summarization of data

5.4.1 Descriptive statistics were expressed : frequency (percentage of collected data), bar graph TEWL on association risk factor of xerosis, bar graph skin hydration on association risk factor of xerosis

5.4.2 Statistical Testing

- Univariate logistic regression analysis: for finding all variables association risk of xerosis and univariate analysis were included in the multivariate analysis.

- Multivariate logistic regression analysis: for finding the factors associated with xerosis in middle -age to elderly patients which we adjust for potential confounders. A level of p-value < 0.05 was considered statistically significance.

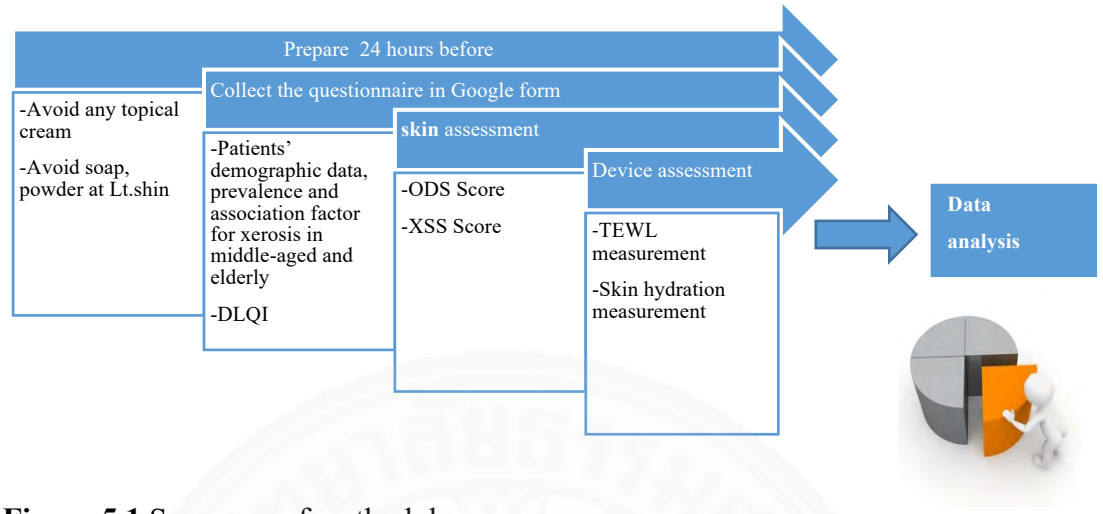


Figure 5.1 Summery of methodology

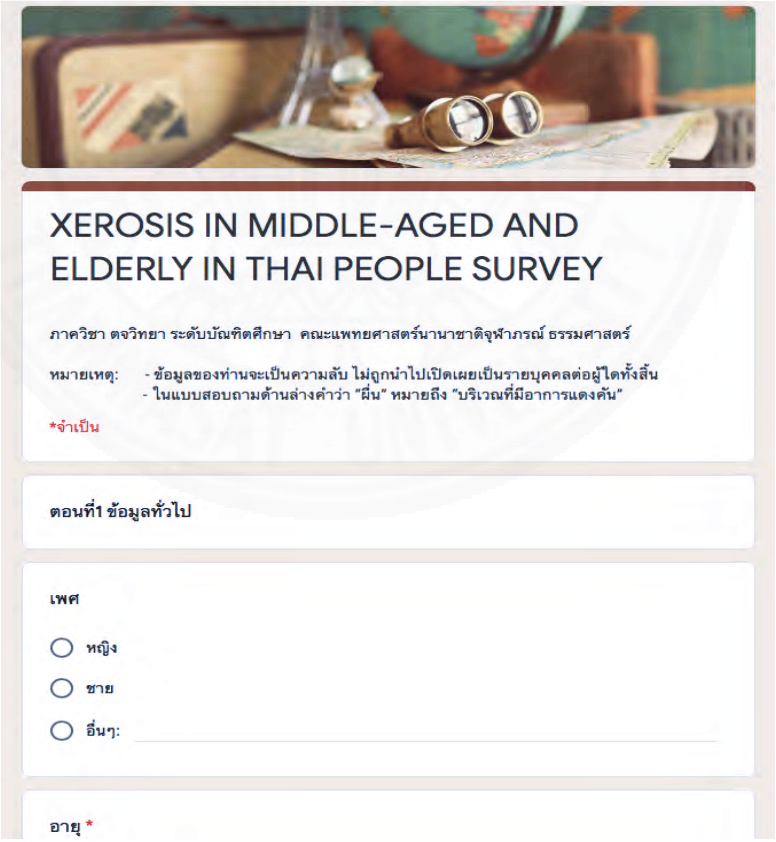


Figure 5.2 Google form questionnaire**.** Link to Google form questionnaire: https://forms.gle/QHQt3tmPpuMiRASLA

CHAPTER 6
RESULTS

6.1 Demographic data and univariate analysis of participants

This observational study search for potential determinants of prevalence and relative factors of xerosis in middle age and elderly. Questionnaires were answered by all 163 participants. According to demographic data showed in Table6.1. The prevalence of any degree of xerosis was 100% in 163 participants. The mean age was 65.09 years ± 6.98; 18.40% was male, 81.6% was female. Mostly is Thai nationality. The careers before retirement in case of outdoor activity do not appear to be a mark with xerosis. The prevalence was higher in the housewife/husband's caregiver (57.06%) who was engaged in indoor activity than the merchant who was engaged in outdoor activity (2.45%). Data univariate analysis (Table 6.10) revealed no significant difference between "very dry skin" and "dry skin" with regard to sex, BMI, and career before retirement. Considering that higher age was significantly associated with risk for higher skin dryness. Age increase 1 is a higher likelihood of very dry skin 1.08 times of dry skin. Thai nationality in middle age was significantly higher skin dryness than half-Thai nationality (OR 0.28, 95%CI 0.09-0.90, p= 0.913).

6.1.1 Concomitant disease (Table6.1.1)

Hypertension was the highest frequent disease (28.8%) while the common other diseases found lower, e.g. diabetes (10.4%), dyslipidemia (6.1%), cardiovascular disease (3.1%). However, it inconclusive that hypertension association with risk of xerosis. The second disease of frequent disease was allergic skin or eczema (19%). Another history of asthma, allergic rhinitis, allergic conjunctivitis was 0.6% ,18.4% and 9.8% consequently. All participants with xerosis found seborrheic dermatitis (9.8%), psoriasis (2.5%), cancer (2.5%), hyperthyroidism (3.1%) and hypothyroidism (1.8%). In univariate logistic regression model (Table 6.11), we found no significant difference with regard to any concomitant disease of middle-aged and elderly in Thai people; diabetes (OR 0.77, 95%CI 0.27-2.20, p= 0.620), dyslipidemia

(OR 4.11, 95% CI 0.51-33.40, p= 0.186), allergic rhinitis (OR 1.00, 95%CI 0.42-2.38, p= 0. 994), allergic conjunctivitis (OR 0. 94, 95% CI 0. 31- 2. 87, p= 0. 913), dermatitis/eczema (OR 1.30, 95%CI 0.54-3.14, p= 0.567), seborrheic dermatitis (OR 1.32 , 95%CI 0.41-4.33, p= 0.643), hyperthyroidism (OR 0.27, 95%CI 0.04-1.69, p=0.163) had more severe skin dryness. However, hypertension associated significantly with the presence of skin dryness severity (OR 3.24, 95%CI 1.34-7.88, p= 0.009)

Table 6.1 Demographic characteristics of participants

	N	Percent
Sex		
male	30	18.40
female	133	81.60
Age (mean±sd)	65.09±6.98	
BMI (mean±sd)	22.89±3.27	
Nationality		
Thai	132	80.98
Thai- Chinese	29	17.79
Thai-American	2	1.23
Careers before retirement	N	Percent
Indoor Careers		
Retired / Government	13	7.98
Pensioners		
housewife's/husband's	93	57.06
caregivers		
Factory employees	2	1.23
Office employees	24	14.72
White-collar employees	8	4.91
Outdoor Careers		
Merchants	4	2.45
Outdoor employees	7	4.29
Others	12	7.36

Table 6.2 Concomitant disease that could be responsible for xerosis

	N	**Percent**
Diabetes		
Yes	17	10.4
No	146	89.6
Hypertension		
Yes	47	28.8
No	116	71.2
Dyslipidemia		

Table 6.2 Concomitant disease that could be responsible for xerosis (Cont.)

	N	Percent
Yes	10	6.1
No	153	93.9
Cardiovascular diseases		
Yes	4	2.5
No	159	97.5
Asthma		
Yes	1	0.6
No	163	99.4
Allergic rhinitis		
Yes	30	18.4
No	133	81.6
Allergic conjunctivitis		
Yes	16	9.8
No	147	90.2
Dermatitis/Eczema		
Yes	31	19.0
No	132	81.0
Renal disease		
Yes	3	1.8
No	160	98.2
Seborrheic dermatitis		
Yes	16	9.8
No	147	90.2
Psoriasis		
Yes	4	2.5
No	159	97.5
Cancer		
Yes	4	2.5
No	159	97.5
Hyperthyroidism		
Yes	5	3.1
No	158	96.9
Hypothyroidism		
Yes	3	1.8
No	160	98.2
Others		
Yes	30	18.4
No	133	81.6

6.1.2 Skin care knowledge (Table 6.3)

The participants who middle-age to older-age, the predominant 49.7% have an idea that the bar soap is suitable for healthy skin than other soap. Some think

about the liquid soap is suitable for their healthy skin. Minimal 8% concern that the pH5 wash soap is suitable for healthy skin. Of the rest, 11.7% indicated no specific soap. For a question about bathing frequency, 73% realized showering frequency contributes to dry skin. For question knowledge about the irritable environment as a harsh brush/exfoliative scrub cause skin barrier damage, and susceptibility to skin dryness, eighty-one percent revealed they knew that it is not good to use the brush/ scrub for showering. There is a scanty number of xerosis participants, 19% revealed they should use a brush/exfoliative scrub to clean their skin while bathing. Knowledge about moisturizer apply after baths and showers for more skin hydration; the data exhibited surprisingly that 41.1 % of our middle-age to older-age group didn't acknowledge it correctly. Nonetheless the results of the univariate analysis between the variables for skincare knowledge tests and severity of skin dryness were not associated as shown in Table 6.12.

Table 6.3 Questions about skin care knowledge

	N	Percent
Q: What type of shower product suitable for healthy skin?		
Liquid soap	50	30.7
pH5 wash soap	13	8.0
Bar soap	81	49.7
No specific	19	11.7
Q: Do you think that showering more than 2 times a day increase moisture to the skin and reduce skin itching?		
Yes	44	27.0
No	119	73.0
Q: Do you think you should use a brush/exfoliative scrub to clean your skin while bathing?		
Yes	31	19.0
No	132	81.0

Table 6.3 Questions about skin care knowledge

	N	Percent
Q: Do you think that it should to apply moisturize after baths and showers?		
Yes	96	58.9
No	67	41.1

6.1.3 Personal history (Table 6.4)

In personal history data, our participants discovered that menopause is the most common finding (68.1%), and taking caffeine is the second common finding (52.1%). Alcohol drinking and smoking are rarely common findings, 4.3% and 1.9% accordingly. When univariate regression analysis was used to find the risk association, it is not found the significant in all variable personal history data. Exception, caffeine intake was statistically significantly associated with very skin dryness (OR3.61, 95% CI 1.76-7.37) shown in Table 6.13.

Table 6.4 Personal history

	N	Percent
Drug allergy		
Yes	40	24.5
No/unknown	123	75.5
Alcohol drinking		
Yes	7	4.3
No	156	95.7
Smoking		
Yes	3	1.9
No	159	98.1
Caffeine intake		
Yes	85	52.1
No	78	47.9
Statin and/or isotretinoin intake		
Yes	59	36.2
No	104	63.8
Using topical treatment for skin dryness before		
Yes	20	12.3
No	143	87.7
Menopause		

Table 6.4 Personal history (Cont.)

	N	Percent
Yes	111	68.1
No	52	31.9

6.1.4 Personal or family history of allergies (Table 6.5)

Skin dryness is strongly associated with pruritus may be an increase in expression nerve elongation factor in dry skin (47, 82). However, 32.5% have experienced chronic itching in their skin, and it appeared in skin rash during childhood or adolescence 23.3%. A percentage of family history atopy were related; 17.8% and were unrelated; 82.2%. In univariate regression analysis we found an association between history of "chronic itching" and xerosis, history of dry skin, erythema rash and skin itching since childhood/adolescence, as shown in Table 6.14.

Table 6.5 Personal or family history of allergies

	N	Percent
Q: Did you experienced chronic itching in your skin?		
Yes	53	32.5
No	110	67.5
Q: Have you ever had a problem dry skin, redness rash, skin itching since childhood or adolescence?		
Yes	38	23.3
No	125	76.7
Q: Do you have personal history or family history of atopy		
Yes	29	17.8
No	134	82.2

6.1.5 Oil supplements (Table 6.6)

Our participants were recorded about history taking oils supplement; according to the result, Fish oil is the most popular (15.3 %) , the secondary popular is Rice bran oil (8.6%), the third favorite is Coconut oil (6.1%). Another oil supplement was Sunflower oils (2.5%), Safflower seed oil (1.8%), and Evening Primrose oil

(1.8%). Nevertheless, we could not find an association between oil supplements and skin dryness in univariate logistic regression analysis (Table 6.15).

Table 6.6 Information for taking oil supplements

	N	Percent
Fish oil		
Yes	25	15.3
No	138	84.7
Sunflower oil		
Yes	4	2.5
No	159	97.5
Safflower seed oil		
Yes	3	1.8
No	160	98.2
Evening Primrose oil		
Yes	3	1.8
No	160	98.2
Rice bran oil		
Yes	14	8.6
No	149	91.4
Coconut oil		
Yes	10	6.1
No	153	93.9

6.1.6 Daily life predisposing skin dryness (Table 6.7)

The environmental exposure that may contribute to skin dryness was asked to participants. The data (Table 6.7) found, mostly of participants favor to use bar soap, the average proportions of people who using bar soap and liquid soap in the household were average 3:2, 60.1%and 45.4%. Respectively, it is reported that 1.2% of them used antiseptic solution showering and 14.1% used brush or exfoliative scrub for skin cleansing. The history of the frequency bathing per day exhibited that most participants (84.1%) took a shower more than one time/day, normally two times/day (80.4%). From an old known that long soaks or hot bathing can affect skin sebum production, we found 11.7% of our participants taking a shower more than fifteen minutes (11.7%). And no soaking bathtub history was found at 98%. There was 44.2% in our participants exposing to hot/warm water while bathing, the rest 55.8% of them took cold/room temperature bathing. The use of talcum powder for hygiene appears to increase in the middle age to the elderly; the study found 73.6% used it. 20.9% of this

group is also founded using fragrance cream. Moisturizer using is found to be 60.1% using a moisturizer daily. Air conditioners to provide efficient cooling during Thai weather; however, it may affect the dry skin of ambient air; 33.1% of our participants live or work in air-conditioned rooms during the day, while 66.9% of them do not live/work in air-conditioned rooms, both of which still have skin dryness. Itching when sweating was observed; 26.4% feel itchy symptoms when sweating. Drinking water per day; 63.2% drink < 8 glasses per day, 36.8% drink ≥ 8 glasses per day. In univariate logistic regression analysis "drinking water < 8 glasses per day" association with xerosis was shown (OR 2.66, 95% CI 1.33-5.30) (Table 6.16)

Table 6.7 Questions about participant's daily life predisposing skin dryness

	N	**Percent**
Bar soap bathing		
Yes	98	60.1
No	65	39.9
Liquid soap bathing		
Yes	74	45.4
No	89	54.6
Septic solution soap bathing		
Yes	2	1.2
No	161	98.8
Brush/exfoliative scrub using		
Yes	23	14.1
No	140	85.9
Take a shower > 1 time/day		
Yes	137	84.0
No	26	16.0
Number of showers		
1 time/day	26	16.0
2 times/day	131	80.4
3 times/day	5	3.1
>3 times/day	1	0.6
Take shower for a long time		
Yes	50	30.7
No	113	69.3

Table 6.7 Questions about participant's daily life predisposing skin dryness (Cont.)

	N	Percent
Timing of shower		
1-5 min	42	25.8
5-10 min	65	39.9
10-15 min	37	22.7
>15 min	19	11.7
Soaking bathtub		
Yes	2	1.2
No	161	98.8
Hot/warm bathing		
Yes	72	44.2
No	91	55.8
Talc/ powder using		
Yes	120	73.6
No	43	26.4
Fragrance cream		
Yes	34	20.9
No	129	79.1
Moisturizer using		
Yes	98	60.1
No	65	39.9
Air-conditioner environment during the day		
Yes	54	33.1
No	109	66.9
Itching when sweating		
Yes	43	26.4
No	120	73.6
Drinking water (per day)		
< 8 glasses	103	63.2
≥ 8 glasses	60	36.8

6.1.7 Information related sun exposure (Table 6.8)

As a result of increasing ultraviolet radiation to the skin by sun exposure, having an outdoor hobby was associated with low SC hydration. We asked all participants about UV radiation exposure during the day; finding 33.1% of participants had outdoor activities/the daily hobby, 22.1% of participants did not wear covered-up clothing while on an outing. To be wondered, the association between sun exposure history and xerosis was not found in univariate analysis (Table 6.17).

Table 6.8 Information related sun exposure

	N	Percent
Outdoor activities or sun exposed during the day		
Yes	54	33.1
No	109	66.9
Wearing covered outfits, trousers / long skirts while outing		
Yes	124	78.0
No	35	22.0

6.1.8 Disturbance quality of life (Table 6.9)

A large percent of 60.1% of participants who have xerosis responded that they feel itchy or stinging their dry skin during the past week. The time when they feel itchy/stinging show variable; midday 31.6%, evening 30.6%, before going to bed 28.6% and morning 9.2% orderly. In Table 6.18, the regression model found no association between disturbance of quality of life and xerosis.

Table 6.9 Disturbance quality of life

	N	Percent
Q: Did you feel itchy or stinging your dry skin during the past week?		
Yes	98	60.1
No	65	39.9
Q: What time when you feel itchy/stinging your skin?		
Morning	9	9.2
Midday	31	31.6
Evening	30	30.6
Before going to bed	28	28.6

Table 6.10 Demographic data in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Sex												
male	25 (21.9)	5 (10.2)	2.47 (0.89-6.90)	0.084	10 (17.5)	3 (9.1)	2.13 (0.54-8.37)	0.280	15 (26.3)	2 (12.5)	2.50 (0.51-12.32)	0.260
female	89 (78.1)	44 (89.8)			47 (82.5)	30 (90.9)			42 (73.7)	14 (87.5)		
Age	66.17±6.54	62.57 ±7.37	1.08 (1.03-1.14)	0.004								
BMI	23.18±3.30	22.23 ±3.13	1.10 (0.99-1.23)	0.091			1.09 (0.95-1.25)	0.227			1.09 (0.90-1.31)	0.382
Nationality												
Thai	90 (78.90)	42 (85.71)	0.63 (0.25-1.56)	0.316	38 (66.70)	29 (87.88)	0.28 (0.09-0.90)	0.033	52 (91.23)	13 (81.25)	2.4 (0.51-11.36)	0.270
Thai-Chinese/Thai-American	24 (21.10)	7 (14.29)			19 (33.30)	4 12.12)			5 (8.77)	3 18.75)		
Career before retirement												
Indoor Careers	78 (68.42)	28 (57.14)	1.63 (0.82-3.24)	0.168	38 (66.67)	18 (54.55)	1.67 (0.69-4.01)	0.255	40 (70.18)	10 (62.50)	1.41 (0.44-4.50)	0.560
Outdoor Careers	36 (31.58)	21 (42.86)			19 (33.33)	15 (45.45)			17 (29.82)	6 (37.50)		

Table 6.11 Concomitant disease in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Diabetes												
Yes	11 (9.6)	6 (12.2)	0.77 (0.27-2.20)	0.620	5 (8.8)	5 (15.2)	0.54 (0.14-2.02)	0.359	6 (10.5)	1 (6.3)	1.77 (0.20-15.83)	0.612
No	103 (90.4)	43 (87.8)			52 (91.2)	28 (84.8)			51 (89.5)	15 (93.8)		
Hypertension												
Yes	40 (35.1)	7 (14.3)	3.24 (1.34-7.88)	0.009	15 (26.3)	3 (9.1)	3.57 (0.95-13.44)	0.060	25 (43.9)	4 (25.0)	2.34 (0.67-8.15)	0.181
No	74 (64.9)	42 (85.7)			42 (73.7)	30 (90.9)			32 (56.1)	12 (75.0)		
Dyslipidemia												
Yes	9 (7.89)	1 (2.04)	4.11 (0.51-33.40)	0.186	3 (5.26)	1 (3.03)	1.78 (0.18-17.82)	0.625	6 (10.53)	0 (0.00)	-	-
No	105 (92.11)	48 (97.96)			54 (94.74)	32 (96.97)			51 (89.47)	16 (100.00)		
Cardiovascular diseases												
Yes	4 (3.51)	0 (0.00)	-	-	3 (5.26)	0 (0.00)	-	-	1 (1.75)	0 (0.00)	-	-

Table 6.11 Concomitant disease in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Asthma												
Yes	0 (0.0)	1 (2.0)	-	-	0 (0.0)	1 (3.0)	-	-	0 (0.0)	0 (0.0)	-	-
No	114 (100.0)	48 (98.0)			57 (100.0)	32 (97.0)			57 (100.0)	16 (100.0)		
Allergic rhinitis												
Yes	21 (18.4)	9 (18.4)	1.00 (0.42-2.38)	0.994	11 (19.3)	4 (12.1)	1.73 (0.50-5.96)	0.383	10 (17.5)	5 (31.3)	0.47 (0.13-1.65)	0.237
No	93 (81.6)	40 (81.6)			46 (80.7)	29 (87.9)			47 (82.5)	11 (68.8)		
Allergic conjunctivitis												
Yes	11 (9.6)	5 (10.2)	0.94 (0.31-2.87)	0.913	7 (12.3)	3 (9.1)	1.40 (0.34-5.83)	0.644	4 (7.0)	2 (12.5)	0.53 (0.88-3.19)	0.486
No	103 (90.4)	44 (89.8)			50 (87.7)	30 (90.9)			53 (93.0)	14 (87.5)		
Dermatitis/Eczema												
Yes	23 (20.2)	8 (16.3)	1.30 (0.54-3.14)	0.567	9 (15.8)	4 (12.1)	0.74 (0.21-2.61)	0.634	14 (24.6)	4 (25.0)	1.02 (0.28-3.69)	0.971
No	91 (79.8)	41 (83.7)			48 (84.2)	29 (87.9)			43 (75.4)	12 (75.0)		

Table 6.11 Concomitant disease in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Renal disease												
Yes	3 (2.6)	0 (0.0)	-	-	0 (0.0)	0 (0.0)	-	-	3 (5.3)	0 (0.0)	-	-
No	111 (97.4)	49 (100.0)			57 (100.0)	33 (100.0)			54 (94.7)	16 (100.0)		
Seborrheic dermatitis												
Yes	12 (10.5)	4 (8.2)	1.32 (0.41-4.33)	0.643	5 (8.8)	2 (6.1)	1.49 (0.27-8.15)	0.645	7 (12.3)	2 (12.5)	0.98 (0.18-5.26)	0.981
No	102 (89.5)	45 (91.8)			52 (91.2)	31 (93.9)			50 (87.7)	14 (87.5)		
Psoriasis												
Yes	4 (2.5)	0 (0.0)	-	-	0 (0.0)	0 (0.0)	-	-	4 (7.0)	0 (0.0)	-	-
No	110 (96.5)	49 (100.0)			57 (100.0)	33 (100.0)			53 (93.0)	16 (100.0)		
Cancer												
Yes	4 (3.5)	0 (0.0)	-	-	1 (1.8)	0 (0.0)	-	-	3 (5.3)	0 (0.0)	-	-
No	110 (96.5)	49 (100.0)			56 (98.2)	33 (100.0)			54 (94.7)	16 (100.0)		
Hyperthyroidism												

Table 6.11 Concomitant disease in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Yes	2 (1.8)	3 (6.1)	0.27 (0.04-1.69)	0.163	0 (0.0)	2 (6.1)	-	-	2 (3.5)	1 (6.3)	0.55 (0.05-6.43)	0.630
No	112 (98.2)	46 (93.9)			57 (100.0)	31 (93.9)			55 (96.5)	15 (93.8)		
Hypothyroidism												
Yes	3 (2.6)	0 (0.0)	-	-	0 (0.0)	0 (0.0)	-	-	3 (5.3)	0 (0.0)	-	-
No	111 (97.4)	49 (100.0)			57 (100.0)	33 (100.0)			54 (94.7)	16 (100.0)		
Others												
Yes	23 (20.2)	7 (14.3)	1.52 (0.60-3.81)	0.376	10 (17.5)	4 (12.1)	1.54 (0.44-5.38)	0.469	13 (22.8)	3 (18.8)	1.28 (0.32-5.19)	0.729
No	91 (79.8)	42 (85.7)			47 (82.5)	29 (87.9)			44 (77.2)	13 (81.3)		

Table 6.12 Skin care knowledge in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Q: What type of shower product suitable for heathy skin?												
Liquid soap	37 (32.5)	13 (26.5)	Ref.	-	18 (31.6)	8 (24.2)	Ref.	-	19 (33.3)	5 (31.3)	Ref.	-
pH5 wash soap	8 (7.0)	5 (10.2)	0.56 (0.16-2.03)	0.379	5 (8.8)	3 (9.1)	0.74 (0.14-3.88)	0.722	3 (5.3)	2 (12.5)	0.40 (0.05-3.04)	0.372
Bar soap	56 (49.1)	25 (51.0)	0.79 (0.36-1.73)	0.552	28 (49.1)	19 (57.6)	0.66 (0.24-1.810	0.655	28 (49.1)	6 (37.5)	1.23 (0.33-4.61)	0.751
No specific	13 (11.4)	6 (12.2)	0.76 (0.24-2.42)	0.644	6 (10.5)	3 (9.1)	0.89 (0.18-4.48)	0.886	7 (12.3)	3 (18.8)	0.61 (0.12-3.27)	0.568
Q: Do you think that showering more than 2 times a day increase moisture to the skin and reduce skin itching?												
Yes	30 (26.3)	14 (28.6)	0.89 (0.42-1.88)	0.766	12 (21.1)	10 (30.3)	0.61 (0.23-1.63)	0.33	18 (31.6)	4 (25.0)	1.39 (0.39-4.89)	0.613
No	84 (73.7)	35 (71.4)			45 (78.9)	23 (69.7)			39 (68.4)	12 (75.0)		

Table 6.12 Skin care knowledge in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Q: Do you think you should use a brush/exfoliative scrub to clean your skin while bathing?												
Yes	20 (17.5)	11 (22.4)	0.74 (0.32-1.68)	0.465	11 (19.3)	8 (24.2)	0.75 (0.27-2.10)	0.580	9 (15.8)	3 (18.8)	0.81 (0.19-3.44)	0.778
No	94 (82.5)	38 (77.6)			46 (80.7)	25 (75.8)			48 (84.2)	13 (81.3)		
Q: Do you think that it should to apply moisturize after baths and showers?												
Yes	64 (56.1)	32 (65.3)	0.68 (0.34-1.36)	0.277	33 (57.9)	19 (57.6)	1.01 (0.43-2.41)	0.976	31 (54.4)	13 (81.3)	0.28 (0.07-1.07)	0.063
No	50 (43.9)	17 (34.7)			24 (42.1)	14 (42.4)			26 (45.6)	3 (18.8)		

Table 6.13 Personal history, potentially related to xerosis in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Drug allergy												
Yes	28 (24.6)	12 (24.5)	1.00 (0.46-0.22)	0.992	14 (24.6)	8 (24.2)	1.017 (0.38-2.76)	0.973	14 (24.6)	4 (25.0)	0.98 (0.27-3.52)	0.971
No/unknown	86 (75.4)	37 (75.5)			43 (75.4)	25 (75.8)			43 (75.4)	12 (75.0)		
Alcohol drinking												
Yes	5 (4.4)	2 (4.1)	1.08 (0.20-5.76)	0.930	1 (1.8)	1 (3.0)	0.57 (0.04-9.45)	0.696	4 (7.0)	1 (6.3)	1.13 (0.12-10.90)	0.915
No	109 (95.6)	47 (95.9)			56 (98.2)	32 (97.0)			53 (93.0)	15 (93.8)		
Smoking												
Yes	3 (2.6)	0 (0.0)	-	-	1 (1.8)	0 (0.0)	-	-	2 (3.5)	0 (0.0)	-	-
No	111 (97.4)	48 (100.0)			56 (98.2)	33 (100.0)			55 (96.5)	15 (100.0)		
Caffeine intake												
Yes	70 (61.4)	15 (30.6)	3.61 (1.76-7.37)	**< 0.001**	32 (56.1)	10 (30.3)	2.94 (1.19-7.30)	0.020	38 (66.7)	5 (31.3)	4.40 (1.34-14.49)	0.015
No	44 (38.6)	34 (69.4)			25 (43.9)	23 (69.7)			19 (33.3)	11 (68.8)		

Table 6.13 Personal history, potentially related to xerosis in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Alcohol drinking												
Yes	5 (4.4)	2 (4.1)	1.08 (0.20-5.76)	0.930	1 (1.8)	1 (3.0)	0.57 (0.04-9.45)	0.696	4 (7.0)	1 (6.3)	1.13 (0.12-10.90)	0.915
No	109 (95.6)	47 (95.9)			56 (98.2)	32 (97.0)			53 (93.0)	15 (93.8)		
Smoking												
Yes	3 (2.6)	0 (0.0)	-	-	1 (1.8)	0 (0.0)	-	-	2 (3.5)	0 (0.0)	-	-
No	111 (97.4)	48 (100.0)			56 (98.2)	33 (100.0)			55 (96.5)	15 (100.0)		
Caffeine intake												
Yes	70 (61.4)	15 (30.6)	3.61 (1.76-7.37)	**< 0.001**	32 (56.1)	10 (30.3)	2.94 (1.19-7.30)	0.020	38 (66.7)	5 (31.3)	4.40 (1.34-14.49)	0.015
No	44 (38.6)	34 (69.4)			25 (43.9)	23 (69.7)			19 (33.3)	11 (68.8)		
Statin and/or isotretinoin intake												
Yes	46 (40.4)	13 (26.5)	1.87 (0.90-3.92)	0.095	15 (26.3)	8 (24.2)	1.12 (0.41-3.01)	0.828	31 (54.4)	5 (31.5)	2.62 (0.81-8.53)	0.109
No	68 (59.6)	36 (73.5)			42 (73.7)	25 (75.8)			26 (45.6)	11 (68.8)		

Table 6.13 Personal history, potentially related to xerosis in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Using topical treatment for skin dryness before												
Yes	16 (14.0)	4 (8.2)	1.84 (0.58-5.81)	0.301	5 (8.8)	3 (9.1)	0.96 (0.21-4.31)	0.959	11 (19.3)	1 (6.3)	3.59 (0.43-30.14)	0.240
No	98 (86.0)	45 (91.8)			52 (91.2)	30 (90.9)			46 (80.7)	15 (93.8)		
Menopause												
Yes	76 (66.7)	35 (71.4)	0.80 (0.39-1.66)	0.550	40 (70.2)	25 (75.8)	0.75 (0.28-2.00)	0.569	36 (63.8)	10 (62.5)	1.03 (0.33-3.24)	0.962
No	38 (33.3)	14 (28.6)			17 (29.8)	8 (24.2)			21 (36.8)	6 (37.5)		

Table 6.14 Personal or family history of allergies in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Q: Did you experienced chronic itching in your skin?												
Yes	43 (37.7)	10 (20.4)	2.36 (1.07-5.21)	0.033	18 (31.6)	6 (18.2)	2.08 (0.73-5.91)	0.171	25 (43.9)	4 (25.0)	2.34 (0.67-8.15)	0.818

Table 6.14 Personal or family history of allergies in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
No	71 (62.3)	39 (79.6)			39 (68.4)	27 (81.8)			32 (56.1)	12 (75.0)		
Q: Have you ever had a problem dry skin, redness rash, skin itching since childhood or adolescence?												
Yes	32 (28.1)	6 (12.2)	2.80 (1.09-7.21)	0.033	15 (26.3)	4 (12.1)	2.60 (0.78-8.60)	0.120	17 (29.8)	2 (12.5)	2.98 (0.61-14.54)	0.178
No	82 (71.9)	43 (87.8)			42 (73.7)	29 (87.9)			40 (70.2)	14 (87.5)		
Q: Do you have personal history or family history of atopy												
Yes	23 (20.2)	6 (12.2)	1.81 (0.69-4.77)	0.229	14 (24.6)	4 (12.1)	2.36 (0.71-7.89)	0.163	9 (15.8)	2 (12.5)	1.31 (0.25-6.79)	0.746
No	91 (79.8)	43 (87.8)			43 (75.4)	29 (87.9)			48 (84.2)	14 (87.5)		

Table 6.14 Personal or family history of allergies in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
No	71 (62.3)	39 (79.6)			39 (68.4)	27 (81.8)			32 (56.1)	12 (75.0)		
Q: Have you ever had a problem dry skin, redness rash, skin itching since childhood or adolescence?												
Yes	32 (28.1)	6 (12.2)	2.80 (1.09-7.21)	0.033	15 (26.3)	4 (12.1)	2.60 (0.78-8.60)	0.120	17 (29.8)	2 (12.5)	2.98 (0.61-14.54)	0.178
No	82 (71.9)	43 (87.8)			42 (73.7)	29 (87.9)			40 (70.2)	14 (87.5)		
Q: Do you have personal history or family history of atopy												
Yes	23 (20.2)	6 (12.2)	1.81 (0.69-4.77)	0.229	14 (24.6)	4 (12.1)	2.36 (0.71-7.89)	0.163	9 (15.8)	2 (12.5)	1.31 (0.25-6.79)	0.746
No	91 (79.8)	43 (87.8)			43 (75.4)	29 (87.9)			48 (84.2)	14 (87.5)		

Table 6.15 Oil supplements in logistic in regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Fish oil												
Yes	18 (15.8)	7 (14.3)	1.13 (0.44-2.90)	0.807	9 (15.8)	5 (15.2)	1.05 (0.32-3.45)	0.936	9 (15.8)	2 (12.5)	1.31 (0.25-6.79)	0.746
No	96 (84.2)	42 (85.7)			48 (84.2)	28 (84.8)			48 (84.2)	14 (87.5)		
Sunflower oil												
Yes	1 (2.0)	3 (2.6)	1.30 (0.13-12.79)	0.824	0 (0.0)	1 (3.0)	-	-	3 (5.3)	0 (0.0)	-	-
No	111 (97.4)	48 (98.0)			57 (100.0)	32 (97.0)			54 (94.7)	16 (100.0)		
Safflower seed oil												
Yes	3 (2.6)	0 (0.0)	-	-	1 (1.8)	0 (0.0)	-	-	2 (3.5)	0 (0.0)	-	-
No	111 (97.4)	49 (100.0)			56 (98.2)	33 (100.0)			55 (96.5)	16 (100.0)		
Evening Primrose oil												

Table 6.15 Oil supplements in logistic in regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Yes	3 (2.6)	0 (0.0)	-	-	1 (1.8)	0 (0.0)	-	-	2 (3.5)	0 (0.0)	-	-
No	111 (97.4)	49 (100.0)			56 (98.2)	33 (100.0)			55 (96.5)	16 (100.0)		
Rice bran oil												
Yes	10 (8.8)	4 (8.2)	1.08 (0.32-3.63)	0.899	4 (7.0)	4 (12.1)	0.55 (0.13-2.35)	0.418	6 (10.5)	0 (0.0)	-	-
No	104 (91.2)	45 (91.8)			53 (93.0)	29 (87.9)			51 (89.5)	16 (100.0)		
Coconut oil												
Yes	7 (6.1)	3 (6.1)	1.00 (0.25-4.05)	0.997	2 (3.5)	2 (6.1)	0.56 (0.08-4.20)	0.576	5 (8.8)	1 (6.3)	1.44 (0.16-13.31)	0.747
No	107 (93.9)	46 (93.9)			55 (96.5)	31 (93.9)			52 (91.2)	15 (93.8)		

Table 6.16 Daily life predisposing skin dryness in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Bar soap bathing												
Yes	77 (67.5)	21 (42.9)	2.78 (1.39-5.52)	0.004	39 (68.4)	15 (45.5)	2.60 (1.07-6.29)	0.034	38 (66.7)	6 (37.5)	3.33 (1.05-10.55)	0.041
No	37 (32.5)	28 (57.1)			18 (31.6)	18 (54.5)			19 (33.3)	10 (62.5)		
Liquid soap bathing												
Yes	53 (46.5)	21 (42.9)	1.16 (0.59-2.28)	0.669	26 (45.6)	12 (36.4)	1.47 (0.61-3.54)	0.393	27 (47.4)	9 (56.3)	0.70 (0.23-2.14)	0.531
No	61 (53.5)	28 (57.1)			31 (54.4)	21 (63.6)			30 (52.6)	7 (43.8)		
Antiseptic solution soap bathing												
Yes	0 (0.0)	2 (4.1)	-	-	0 (0.0)	2 (6.1)	-	-	0 (0.0)	0 (0.0)	-	-
No	114 (100.0)	47 (95.9)			57 (100.0)	31 (93.9)			57 (100.0)	16 (100.0)		
Brush/exfoliative scrub using												

Table 6.16 Daily life predisposing skin dryness in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Yes	15 (13.2)	8 (16.3)	0.78 (0.31-1.97)	0.595	8 (14.0)	8 (24.2)	0.51 (0.17-1.52)	0.23	7 (12.3)	0 (0.0)	5.17 (<0.0001)	0.999
No	99 (86.8)	41 (83.7)			49 (86.0)	25 (75.8)			50 (87.7)	16 (100.0)		
Take a shower > 1 time/day												
Yes	97 (85.1)	40 (81.6)	1.28 (0.53-3.12)	0.581	47 (82.5)	28 (84.8)	0.84 (0.26-2.71)	0.77	50 (87.7)	12 (75.0)	2.38 (0.60-9.47)	0.218
No	17 (14.9)	9 (18.4)			10 (17.5)	5 (15.2)			7 (12.3)	4 (25.0)		
Number of showers												
1 time/day	17 (14.9)	9 (18.4)	Ref.	-	10 (17.5)	5 (15.2)	Ref.	-	7 (12.3)	4 (25.0)	Ref.	-
2 times/day	93 (81.6)	38 (77.6)	1.30 (0.53-3.16)	0.569	45 (78.9)	26 (78.8)	0.87 (0.27-2.81)	0.810	48 (84.2)	12 (75.0)	2.29 (0.57-9.10)	0.241
3 times/day	3 (2.6)	2 (4.1)	0.79 (0.11-5.66)	0.818	2 (3.5)	2 (6.1)	0.50 (0.05-4.67)	0.543	1 (1.8)	0 (0.0)	-	-
>3 times/day	1 (0.9)	0 (0.0)	-	-	-	-	-	-	1 (1.8)	0 (0.0)	-	-
Take shower for a long time												
Yes	34 (29.8)	16 (32.7)	0.88 (0.43-1.80)	0.720	12 (21.1)	10 (30.3)	0.61 (0.23-1.63)	0.33	22 (38.6)	6 (37.5)	1.05 (0.33-3.29)	0.936

Table 6.16 Daily life predisposing skin dryness in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
No	80 (70.2)	33 (67.3)			45 (78.9)	23 (69.7)			35 (61.4)	10 (62.5)		
Timing of shower												
1-5 min	32 (28.1)	10 (20.4)	Ref.	-	13 (22.8)	6 (18.2)	Ref.	-	19 (33.3)	4 (25.0)	Ref.	-
5-10 min	44 (38.6)	21 (42.9)	0.66 (0.27-1.58)	0.346	24 (42.1)	14 (42.4)	0.79 (0.25-2.55)	0.695	20 (35.1)	7 (43.8)	0.60 (0.15-2.39)	0.470
10-15 min	27 (23.7)	10 (20.4)	0.84 (0.31-2.33)	0.743	14 (24.6)	7 (21.2)	0.92 (0.25-3.48)	0.906	13 (22.8)	3 (18.8)	0.91 (0.17-4.77)	0.913
>15 min	11 (9.6)	8 (16.3)	0.43 (0.14-1.36)	0.152	6 (10.5)	6 (18.2)	0.46 (0.10-2.05)	0.309	5 (8.8)	2 (12.5)	0.53 (0.07-3.75)	0.522
Soaking bathtub												
Yes	2 (1.8)	0 (0.0)	-	-	0 (0.0)	0 (0.0)	-	-	2 (3.5)	0 (0.0)	-	-
No	112 (98.2)	49 (100.0)			57 (100.0)	33 (100.0)			55 (96.5)	16 (100.0)		
Hot/warm bathing												
Yes	58 (50.9)	14 (28.6)	2.59 (1.26-5.32)	0.010	33 (57.9)	10 (30.3)	3.16 (1.27-7.86)	0.013	25 (43.9)	4 (25.0)	2.34 (0.67-8.15)	0.181

Table 6.16 Daily life predisposing skin dryness in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
No	56 (49.1)	35 (71.4)			24 (42.1)	23 (69.7)			32 (56.1)	12 (75.0)		
Talc/ powder using												
Yes	28 (24.6)	15 (30.6)	0.74 (0.35-1.55)	0.422	16 (28.1)	11 (33.3)	0.78 (0.31-1.97)	0.600	12 (21.1)	4 (25.0)	0.80 (0.22-2.93)	0.736
No	86 (75.4)	34 (69.4)			41 (71.9)	22 (66.7)			45 (78.9)	12 (75.0)		
Fragrance cream												
Yes	26 (22.8)	8 (16.3)	1.51 (0.63-3.63)	0.353	11 (19.3)	6 (18.2)	1.08 (0.36-3.24)	0.896	15 (73.7)	2 (12.5)	2.50 (0.51-12.32)	0.260
No	88 (77.2)	41 (83.7)			46 (80.7)	27 (81.8)			42 (73.7)	14 (87.5)		
Moisturizer using												
Yes	69 (60.5)	29 (59.2)	1.06 (0.53-2.09)	0.872	35 (61.4)	19 (57.6)	1.17 (0.49-2.81)	0.721	34 (59.6)	10 (62.5)	0.89 (0.28-2.78)	0.837
No	45 (39.5)	20 (40.8)			22 (38.6)	14 (42.4)			23 (40.4)	6 (37.5)		
Air-conditioner environment during the day												
Yes	36 (31.6)	18 (36.7)	0.80 (0.39-1.60)	0.522	17 (29.8)	13 (39.4)	0.65 (0.27-1.61)	0.355	19 (33.3)	5 (31.3)	1.10 (0.33-3.62)	0.875

Table 6.16 Daily life predisposing skin dryness in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
No	78 (68.4)	31 (63.3)			40 (70.2)	20 (60.6)			38 (66.7)	11 (68.8)		
Itching when sweating												
Yes	31 (27.2)	12 (24.5)	1.15 (0.53-2.49)	0.720	16 (28.1)	7 (21.2)	1.45 (0.53-4.00)	0.474	15 (26.3)	5 (31.3)	0.79 (0.23-2.63)	0.696
No	83 (72.8)	37 (75.5)			41 (71.9)	26 (78.8)			42 (73.7)	11 (68.8)		
Drinking water (per day)												
< 8 glasses	34 (29.8)	26 (53.1)	2.66 (1.33-5.30)	0.005	21 (36.8)	16 (48.5)	1.61 (0.68-3.85)	0.281	13 (22.8)	10 (62.5)	5.64 (1.72-18.47)	0.004
≥ 8 glasses	80 (70.2)	23 (46.9)			36 (63.2)	17 (51.5)			44 (77.2)	6 (37.5)		
Outdoor activities or sun exposed during the day												
Yes	42 (36.8)	12 (24.5)	1.80 (0.85-3.82)	0.127	19 (33.3)	6 (18.2)	2.25 (0.79-6.38)	0.127	23 (40.4)	6 (37.5)	1.13 (0.36-3.53)	0.837
No	72 (63.2)	37 (75.5)			38 (66.7)	27 (81.8)			34 (59.6)	10 (62.5)		
Wearing covered outfits, trousers / long skirts while outing												

Table 6.16 Daily life predisposing skin dryness in logistic regression model (Cont.)

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Yes	88 (77.9)	36 (78.3)	0.98 (0.43-2.24)	0.958	42 (75.0)	25 (78.1)	0.84 (0.30-2.36)	0.741	46 (80.7)	11 (78.6)	1.14 (0.27-4.80)	0.858
No	25 (22.1)	10 (21.7)			14 (25.0)	7 (21.9)			11 (19.3)	3 (21.4)		

Table 6.17 Information related sun exposure in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)		Very dry skin	Dry skin	OR (95% CI)		Very dry skin	Dry skin	OR (95% CI)	P-value
Outdoor activities or sun exposed during the day												
Yes	42 (36.8)	12 (24.5)	1.80 (0.85-3.82)	0.127	19 (33.3)	6 (18.2)	2.25 (0.79-6.38)	0.127	23 (40.4)	6 (37.5)	1.13 (0.36-3.53)	0.837
No	72 (63.2)	37 (75.5)			38 (66.7)	27 (81.8)			34 (59.6)	10 (62.5)		
Wearing covered outfits, trousers / long skirts while outing												
Yes	88 (77.9)	36 (78.3)	0.98 (0.43-2.24)	0.958	42 (75.0)	25 (78.1)	0.84 (0.30-2.36)	0.741	46 (80.7)	11 (78.6)	1.14 (0.27-4.80)	0.858
No	25 (22.1)	10 (21.7)			14 (25.0)	7 (21.9)			11 (19.3)	3 (21.4)		

Table 6.18 Disturbance quality of life in logistic regression model

Variable	Total				45-65 year				> 65 year			
	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value	Very dry skin	Dry skin	OR (95% CI)	P-value
Q: Did you feel itchy or stinging your dry skin during the past week?												
Yes	67 (58.8)	31 (63.3)	0.83 (0.42-1.65)	0.591	32 (56.1)	21 (63.6)	0.73 (0.30-1.77)	0.487	35 (61.4)	10 (62.5)	0.96 (0.30-3.00)	0.936
No	47 (41.2)	18 (36.7)			25 (43.9)	12 (36.4)			22 (38.6)	6 (37.5)		
Q: What time when you feel itchy/stinging your skin?												
Morning	7 (10.4)	2 (6.5)	Ref.	-	3 (9.4)	2 (9.5)	Ref.	-	4 (11.4)	0 (0.0)	-	-
Midday	21 (31.3)	10 (32.3)	0.60 (0.11-3.43)	0.566	15 (46.9)	7 (33.3)	1.42 (0.19-10.57)	0.727	6 (17.1)	3 (30.0)	-	-
Evening	21 (31.3)	9 (29.0)	0.67 (0.12-3.86)	0.651	6 (18.8)	5 (23.8)	0.80 (0.09-6.85)	0.839	15 (42.9)	4 (40.0)	-	-
Before going to bed	18 (26..9)	10 (32.3)	0.51 (0.09-2.96)	0.514	8 (25.0)	7 (33.3)	0.76 (0.10-5.96)	0.796	10 (28.6)	3 (30.0)	-	-

6.2 Main results

A total of 163 participants was affected by dry skin. Our primary outcome finding the prevalence of any degree of xerosis in this population was 100%. This observational study found the prevalence of xerosis in males (18.4%) less than in females (81.6%); however, sex was not a significant association with xerosis. (OR 2.47 , 95%CI 0.89-6.90, p= 0.084) (Table 6.10). We perform both the subjective assessment and objective assessment. First, the subjective assessment, ODS, and XSS scores were used to identify the clinical severity of our participants. The examination was done by one board-certified dermatologist and one trained dermatologist medicine according to inter-rater agreement at 82%, the average agreement at the standard level is fairly good. The result of ODS and XSS score in all participants show in the same direction in slope descending pattern as shown in the bar graph (Figure 6.1). Mostly of participants have mild clinical severity. The ODS score peak at grading 1-2 description sign of faint scaling and small scale, XSS showed scale 1-3, in mild to moderate severity. In the second step, the objective assessment, Tewameter, and Corneometer were collected skin dryness at the shin site area. The correlation of each subjective method and objective method measurements were calculated agreement by Spearman's correlation method. The result show no found correlation between Tewameter and Corneometer hydration value , also ODS and XSS score; Tewameter and Corneometer value (r= 0.056, p-value = 0.479), Tewameter value and ODS score (rho = -0.047, p-value = 0.548), Tewameter and XSS score (rho = -0.080, p-value = 0.307), respectively.
Corneometer value is good correlation with xerosis severity in ODS and XSS score show in negative relation; Corneometer value and ODS score (rho = -0.586, p-value < 0.001), Corneometer value and XSS score (rho = -0.605, p-value < 0.001). Thus, Corneometer as a good tool to define skin dryness.

6.2.1 Interpretation skin dryness base on Corneometer measurement

Corneometer used to define skin dryness interpret result stratum corneum hydration on legs site by < 35 describe very dry, 35-50 describe dry, >50 describe sufficient moisture. Following interpreted, 69.9% of participants had very dry

skin and 30.1% had dry skin (Table 6.19). Percent of skin dryness individual age group show in Table6.2.2; Age45-65 years found dry skin 67.3%, very dry skin 50.5%. Age >65 years found dry skin 32.7%, very dry 50%. It can define that the middle age group (45-65 yrs.) has dry skin problems more, whereas the elderly group (>65 yrs.) has very dry skin problems more comparison between the individual age group. The mean age in "Dry skin" group was 62.57±7.37 and the mean age in "Very dry skin" group was 66.17±6.54. A univariate and multivariate logistic regression model was created to find the factors associated with skin dryness adjustment for covariates show in Table6.2.3. The significant risk factors associated with xerosis (severity) were age, caffeine intake, bar soap using, hot/lukewarm bathing, drinking water/day less than 8 glasses (200ml/glass). All the above factors affect to deteriorate skin dryness from dry skin to very dry skin. Risk association according TEWL and stratum corneum hydration as resulted in figure 6.2 and figure 6.3 respectively. (Figure 6.2). A higher severity of xerosis was associated with older age (OR 1.07, 95% CI 1.01-1.14, p = 0.016). Caffeine intake that could be responsible for higher skin dryness (OR 2.48, 95% CI 1.14-5.43, p = 0.023). Bar soap using (OR 2.21, 95% CI 1.04-4.71, p = 0.023) significant increase in skin dryness. Whereas individual lotion soap using, an antiseptic detergent and fragrance detergents using did not significant association with skin dryness. Hot/lukewarm bathing showed significant severe dry skin (OR 2.35, 95% CI 1.05-5.27, p = 0.037). Drinking water less than 8 glasses per day result positively associated very skin dryness (OR 2.22, 95% CI 1.04-4.76, p = 0.040) than those who drinking water more than or even 8 glasses per day. Subgroup by age groups (Table 6.22), we found both Thai nationality and caffeine intake significantly associated with very xerosis in 45-65 years of age. Caffeine intake has to increase severity skin dryness; people who drink caffeine having 3.53 odds of people who don't drink caffeine (OR 3.53,95%CI 1.36-9.16, p= 0.010). Thai nationality has a risk of very skin dryness 0.22 times of half-Thai nationality (OR 0.22, 95%CI 0.07-0.76, p = 0.017)

Table 6.19 Percent of stratum corneum hydration

Corneometer value	Frequency	Percent
>50	0	0
>= 35-50	49	30.1
< 35	114	69.9
Total	163	100.0

Table 6.20 Percent of skin dryness individual age group

Age (yr.)		Dry	Very dry	Total
45-65	N	33	57	90
	% Column	67%	50%	55%
	% Row	37%	63%	100%
>65	N	16	57	73
	% Column	33%	50%	45%
	% Row	22%	78%	100%
Total		49	114	163

Table 6.21 Univariate and multivariable logistic regression model predisposing factors association skin dryness

Variable	Very Dry skin (N=114, 69.9%)	Dry skin (N=49, 30.1%)	Univariate		Multivariate	
			OR (95% CI)	p-value	OR (95% CI)	p-value
Age	66.17±6.54	62.57±7.37	1.08 (1.03-1.14)	0.004	1.07 (1.01-1.14)	**0.016**
Underlying Hypertension						
Yes	40 (35.1)	7 (14.3)	3.24 (1.34-7.88)	0.009	-	-
NO	74 (64.9)	42 (85.7)				

Table 6.21 Univariate and multivariable logistic regression model predisposing factors association skin dryness (Cont.)

Variable	Very Dry skin (N=114, 69.9%)	Dry skin (N=49, 30.1%)	Univariate		Multivariate	
			OR (95% CI)	p-value	OR (95% CI)	p-value
Caffeine intake						
Yes	70 (61.4)	15 (30.6)	3.61 (1.76-7.37)	<0.001	2.48 (1.14-5.43)	**0.023**
No	44 (38.6)	34 (69.4)				
History of chronic itching						
Yes	43 (37.7)	10 (20.4)	2.36 (1.07-5.21)	0.033	-	-
No	71 (62.3)	39 (79.6)				
History prolong itching/ rash since childhood/adolescent						
Yes	32 (28.1)	6 (12.2)	2.80 (1.09-7.21)	0.033	-	-
No	82 (71.9)	43 (87.8)				
Bar soap using						
Yes	77 (67.5)	21 (42.9)	2.78 (1.39-5.52)	0.004	2.21 (1.04-4.71)	**0.040**
No	37 (32.5)	28 (57.1)				

Table 6.21 Univariate and multivariable logistic regression model predisposing factors association skin dryness (Cont.)

Variable	Very Dry skin (N=114, 69.9%)	Dry skin (N=49, 30.1%)	Univariate		Multivariate	
			OR (95% CI)	p-value	OR (95% CI)	p-value
Hot/Lukewarm bathing						
Yes	58 (50.9)	14 (28.6)	2.59 (1.26-5.32)	0.010	2.35 (1.05-5.27)	**0.037**
No	56 (49.1)	35 (71.4)				
Drinking water/day						
< 8 glasses	80 (70.2)	23 (46.9)	2.66 (1.33-5.30)	0.005	2.22 (1.04-4.76)	**0.040**
≥ 8 glasses	34 (29.8)	26 (53.1)				

Forward Stepwise (Likelihood Ratio)

Table 6.22 Univariate and multivariable logistic regression model predisposing factors association skin dryness subgroup by age group

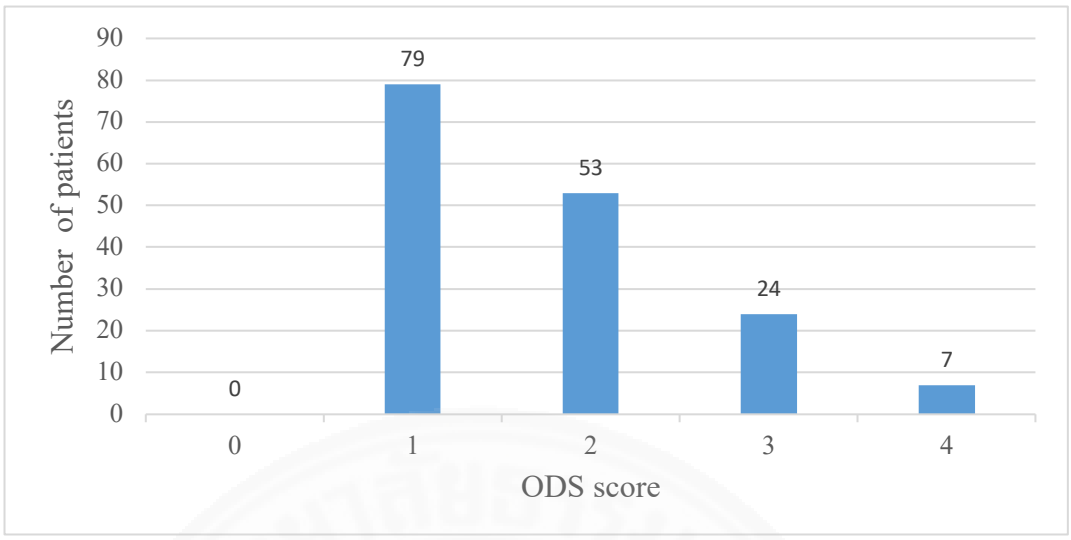
Age 45-65 ปี	**Very Dry skin (N=57, 63.3%)**	**Dry skin (N=33, 36.7%)**	**Univariate**		**Multivariate**	
			OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**
Nationality						
Thai	38 (66.70)	29 (87.88)	0.28 (0.09-0.90)	0.033	0.22 (0.07-0.76)	**0.017**
Chinese/Others	19 (33.30)	4 12.12)				
Caffeine intake						
Yes	32 (56.1)	10 (30.3)	2.94 (1.19-7.30)	0.020	3.53 (1.36-9.16)	**0.010**
No	25 (43.9)	23 (69.7)				
Bar soap using						
Yes	39 (68.4)	15 (45.5)	2.60 (1.07-6.29)	0.034	-	-
No	18 (31.6)	18 (54.5)				
Hot/Lukewarm bathing						
Yes	33 (57.9)	10 (30.3)	3.16 (1.27-7.86)	0.013	-	-
No	24 (42.1)	23 (69.7)				

Forward Stepwise (Likelihood Ratio)

Table 6.22 Univariate and multivariable logistic regression model predisposing factors association skin dryness subgroup by age group (Cont.)

Age > 65 ปี	**Very Dry skin (N=57, 78.1%)**	**Dry skin (N=16, 21.9%)**	**Univariate**		**Multivariate**	
			OR (95% CI)	**p-value**	**OR (95% CI)**	**p-value**
Nationality						
Thai	52 (91.23)	13 (81.25)	2.4 (0.51-11.36)	0.270	-	-
Chinese/Others	5 (8.77)	3 18.75)				
Caffeine intake						
Yes	38 (66.7)	5 (31.3)	4.40 (1.34-14.49)	0.015	5.25 (1.41-19.54)	**0.013**
No	19 (33.3)	11 (68.8)				
Bar soap using						
Yes	38 (66.7)	6 (37.5)	3.33 (1.05-10.55)	0.041	-	-
No	19 (33.3)	10 (62.5)				
Drinking water/day						
< 8 glasses	44 (77.2)	6 (37.5)	5.64 (1.72-18.47)	0.004	6.63 (1.82-24.17)	**0.004**
≥ 8 glasses	13 (22.8)	10 (62.5)				

Forward Stepwise (Likelihood Ratio)



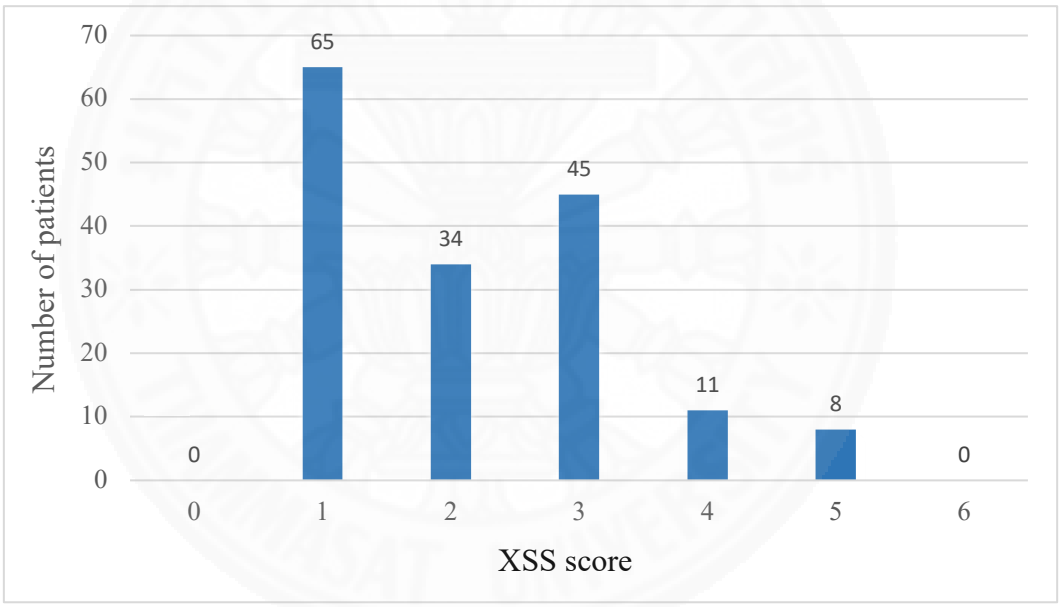


Figure 6.1 Demonstrate clinical assessment of xerosis severity in the study groups according to ODS and XSS score (n = 163).

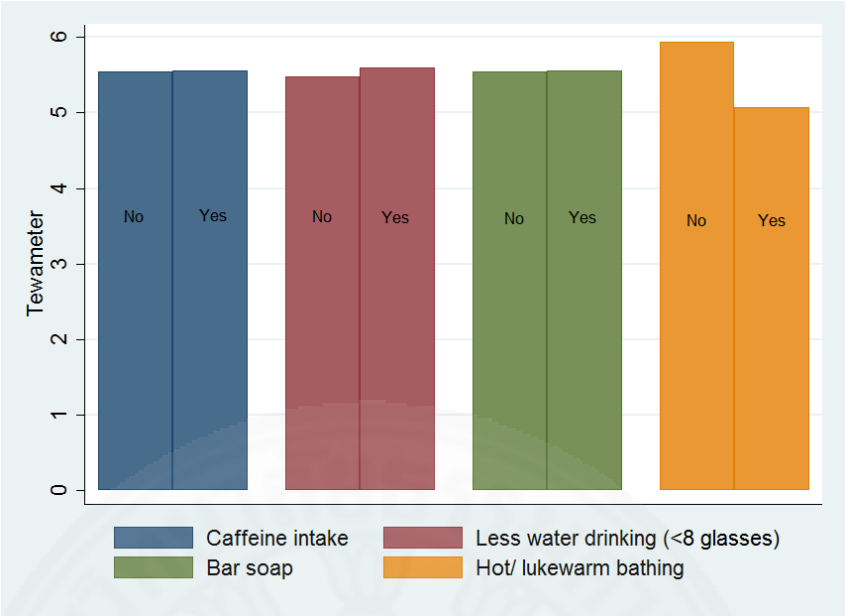


Figure 6.2 Risk association in middle-ages and elderly in Thai-people according TEWL

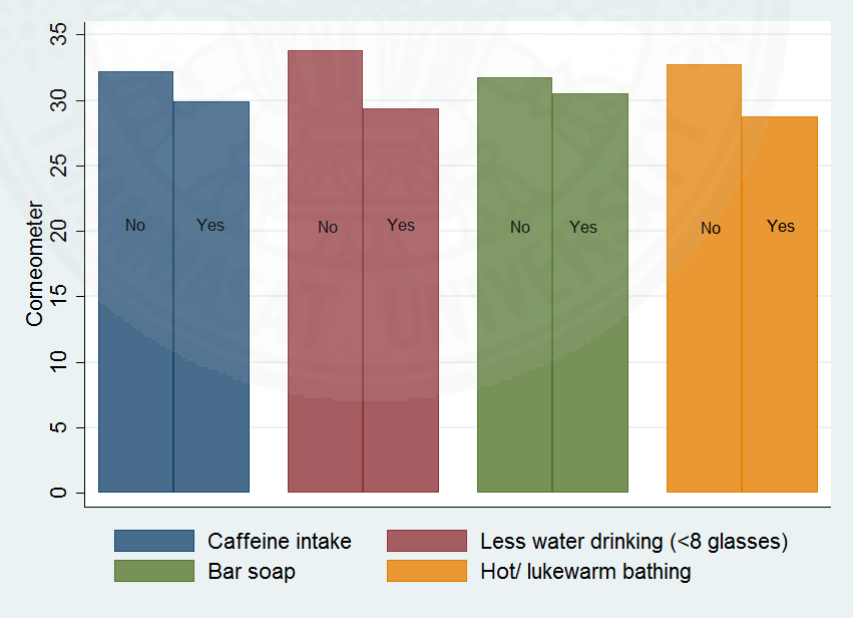


Figure 6.3 Risk association in middle-ages and elderly in Thai-people according the stratum corneum hydration

6.3 Dermatology Life Quality Index (DLQI)

This observation study collected data for 163 participants on the health burden effect of skin dryness. It was adapted interpreting in DLQI following instructions for use DLQI scoring adapted from Finlay, G.K. Khan (82). The answers of all participants about their burden in xerosis conditions are shown in DLQI answering (Table 6.23). For instructions use DLQI scoring, the scoring of each question as follows: very much is scored 3, a lot is scored 2, a little is scored 1, not at all is scored 0, not relevant is scored 0 except question 7, prevented work or studying is scored 3. We calculated DLQI from the summation of a score of each questionnaire. The results interpret of DLQI; 0-1 "no effect at all on patient's life", 2-5 "small effect on patient's life", 6-10 " moderate effect on patient's life", 11-20 " very large effect on patient's life", 21-30 "extremely large effect on patient's life". And the interpretation of summation results is shown in Table 6.4, Figure 6.4.

Table 6.23 Dermatology Life Quality Index (DLQI) questionnaires

	Frequency	**Percentage**
Over the last week, how itchy, sore, painful or stinging has your skin been?		
Very much	10	6.1
A lot	23	14.1
A little	57	35
Not at all	54	33.1
Not relevant	19	11.7
Over the last week, how embarrassed or self-conscious have you been because of your skin?		
Very much	3	1.8
A lot	15	9.2
A little	33	20.2
Not at all	85	52.1
Not relevant	27	16.6

Over the last week, how much has your skin interfered with you going shopping or looking after your home or garden?		
Very much	1	0.6
A lot	16	9.8
A little	31	19.0
Not at all	88	54.0
Not relevant	27	16.6
Over the last week, how much has your skin influenced the clothes you wear?		
Very much	5	3.1
A lot	12	7.4
A little	34	20.9
Not at all	86	52.8
Not relevant	26	16.0
Over the last week, how much has your skin affected any social or leisure activities?		
Very much	3	1.8
A lot	13	8.0
A little	37	22.7
Not at all	84	51.5
Not relevant	26	16.0
Over the last week, how much has your skin made it difficult for you to do any sport?		
Very much	3	1.8
A lot	13	8.0
A little	37	22.7
Not at all	84	51.5
Not relevant	26	16.0

Over the last week, has your skin prevented you from working or studying? if "No", over the last week how much has your skin been a problem at work or studying?		
Very much	4	2.5
A lot	5	3.1
A little	35	21.5
Not at all	92	56.4
Not relevant	27	16.6
Over the last week, how much has your skin created problems with your partner or any of your close friends or relatives?		
Very much	3	1.8
A lot	5	3.1
A little	31	19.0
Not at all	93	57.1
Not relevant	31	19.0
Over the last week, how much has your skin caused any sexual difficulties?		
Very much	1	0.6
A lot	6	3.7
A little	31	19.0
Not at all	93	57.1
Not relevant	32	19.6
Over the last week, how much of a problem has the treatment for your skin been, for example by making your home messy, or by taking up time?		
Very much	4	2.5
A lot	8	4.9
A little	35	21.5

Not at all		85	52.1
Not relevant		31	19.0
For interpret meaning of DLQI score			
0-1	no effect at all on patient's life		
2-5	small effect on patient's life		
6-10	moderate effect on patient's life		
11-20	very large effect on patient's life		
21-30	extremely large effect on patient's life		

6.3.1 Result of DLQI score

Table 6.4 Result of DLQI score

Interpret DLQI score	Frequency	Percentage
Effect at all on patient's life	89	54.6
Small effect on patient's life	23	14.1
Moderate effect on patient's life	28	17.2
Very large effect on patient's life	20	12.3
Extremely large effect on patient's life	3	1.8

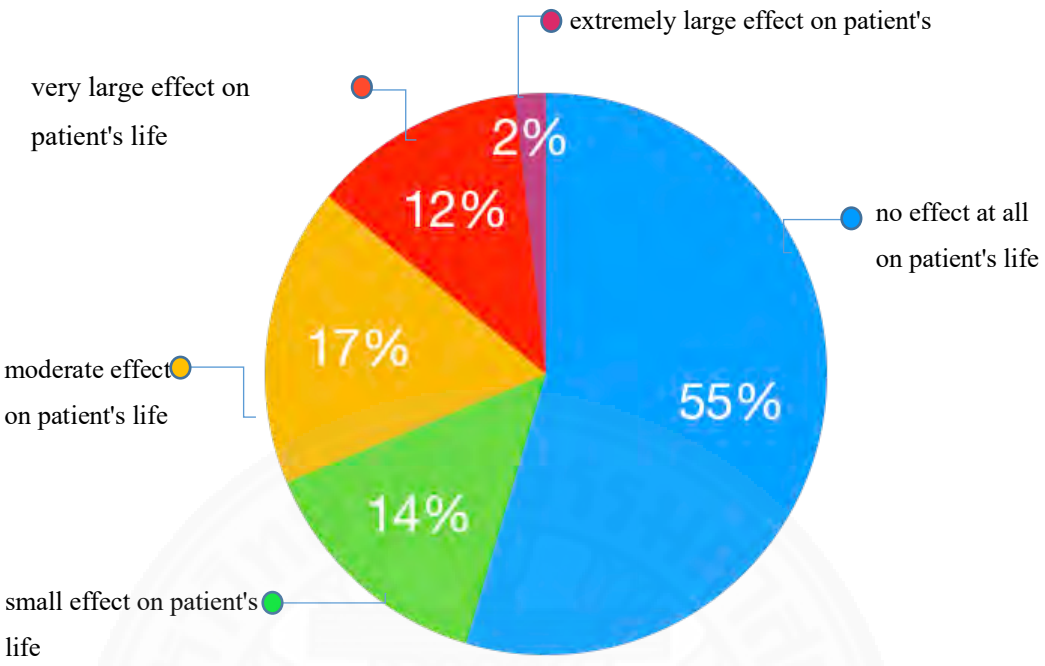


Figure 6.4 Summery of DLQI on the health burden effect of skin dryness

CHAPTER 7
DISCUSSION

Skin dryness or xerosis is a common essential health problem in aging especially in the elderly. This is the first cross-sectional observational study that focused on general Thai people aged 45 or older. The questionnaire base combines clinical score evaluation and device assessment were used in research. The older study mostly in western researches prevalence xerosis cutis in an older population in nursing homes and primary care ranges from 29.5% to 58.3% (1, 3, 4). In our study, the result indicates the prevalence of skin dryness in Thai people in the range of middle age to elderly age population finding 100%. And the average total DLQI score; 55% mostly in participants had shown no effect on the burden of life. DLQI displays a health burden effect on skin dryness. We conclude that it related to the severity score. Most of the participants manifest low severity clinical score; 1-2 according to ODS and XSS represent mild xerosis, a faint scaling. resulting in the DLQI poll show mostly participants no feel effects on their daily life.

Nevertheless, the number prevalence in Thai showing skin dryness in aging who middle-aged to elderly seems critical. Might be the chronological aging, an environment, inadequate skincare knowledge, and skincare habit of Thai people. The higher number 100 % of xerosis in Thai according to be summarized association factors by comparing with the mark severity of xerosis when exposed to risk instead; " Very dry skin " and " Dry skin ". Skin clinical assessment "Very dry skin" and " Dry skin", we cut off ODS grading score 2-4; "Very dry", 1; "Dry" and cut off XSS grading score 3-6; "Very dry", 1-2; "Dry". Device assessment, we used tewameter and corneometer to evaluate skin dryness. From the result data showed SC hydration was not necessarily agreed with TEWL in aging. This suggested that SC hydration is a good indicator of skin dryness rather than TEWL. The measurement of TEWL is a good indicator of skin irritation, most of which was used for the evaluation of skin barrier disease and useful for the evaluation of skin mildness; irritative products, testing the efficiency of moisturizing cosmetic products (83). The critical finding was a low agreement TEWL; tewameter and skin hydration; corneometer evaluations of dry skin which not allow

with the old study. Result of Akimoto et al., 1993 study (36) had found xerosis and asteatotic eczema increased transepidermal water and decreased free fatty acid and triglycerides in SC compared with healthy. An inverse relationship was demonstrated between TEWL and skin hydration when expose to an irritant product or defect barrier function (27, 83). One study, Thune et al., 1988 (84) founded the TEWL values in the patient group decreased, at the same time the skin hydration values increased following one week's topical treatment after exposing alkaline cleansing products in non-atopic elderly patients. We summarized TEWL should be negatively associated with skin hydration however in this study was not found a correlation. Due to agreement with Sotoodian & Maibach, 2012 (85), TEWL values considerable variations that influence skin site measurement, skin surface temperature, room humidity, and the sweating state person being tested. It might explain that the participant's cover with long pants/dress between outside leaving and might be a result of the different timing evaluation between morning and afternoon when using Tewameter. During the daytime, the highest moisture loss, highest skin blood flow occurring at night of circadian rhythms (41). One study support that TEWL is higher in the afternoon and evening compared to the morning, the maximum value of TEWL average at 8.00 PM and minimal value at 8.00 AM-10.00 AM except on the shin site, TEWL highest at 2 peaks at 12.00 AM and 4.00 PM and two lowest at 10.00 PM and 8.00 AM (79). Several personal lifestyle factors were associated with SC hydration, known risk association with skin dryness such as old age, eczema, hot bathing, irritation, frequency of bathing, itching during sweating and previous consensus risk as smoking (1, 4, 9, 12). This study brings common, consensus risk and new probability associations such as allergic disease, sun exposure, skincare knowledge, taking an oil, septic solution showering and caffeine intake with skin dryness to find the association factor that aggravating xerosis in Thai middle age - elderly population. The significant risk factors associated with xerosis in middle-aged and elderly were age, caffeine intake, bar soap using, hot/lukewarm bathing, drinking water/day less than 8 glasses (200ml/glass). These factors contribute to increase significantly the severity of skin dryness from dry to very dry skin.

Advance aging related to skin dryness due to pathophysiologic change in the aging process; failure of water retention, a deficit in skin hydration and impairment normal desquamation. Farage, Miller and Maibach (34) explained the degenerate change in aging skin as a result of a decrease in ceremide 1,3 level and lipid content in stratum corneum. Hashizume's study (37) reported depleting the "natural moisturizing factor" (NMF), which functions the water-binding capacity of the stratum corneum in skin aging. (Li et al., 2010) (14) defined deficiency aquaporin-3 (AQP3) in human skin (AQP3), a membrane channel that allows passage of glycerol and water, as a critical element in maintaining skin hydration via its regulation of glycerol concentration within the cornified layer especially in older than 60 years. Thus, the result of the study could be supported by the pathophysiology of aging explanation. Our study indicates that advanced aging associated with xerosis and xerosis intensity. And it's alarming for skincare at an early age before aging.

Interestingly, caffeine intake risks higher skin dryness. In contrast to the study of Brandner et al. (86) reported that the application of caffeine significantly reduced TEWL in male skin compared to female skin. Thus, international guidelines for assessing transepidermal water loss and skin hydration cited caffeine (topical application) relating exogenous factors to influence TEWL measurements (61). One possible explanation might be the systemic effect of caffeine-induced natriuresis and diuresis and indirectly aggravating skin dryness. Caffeine increases the glomerular filtration rate mediated by the adenosine receptor and also inhibits sodium ion reabsorption on the proximal renal tubules (87).

Bar soap using and hot/lukewarm bathing both were well known for risk associate skin dryness. Bar soap is an alkaline pH cause of irritable skin and it is harsh cleanser compare with liquid soap and mild acidic pH soap, also it washes skin fatty acids and cholesterol susceptible to depletion in moisture skin and skin barrier damage leading skin dryness. Mild moisturizing, pH-neutral soap preferred (54, 55, 57). Hot/lukewarm bathing (OR=2.35, 95%CI=1.05-5.27, p=0.037) increase the likelihood of very skin dry compare with skin dry. This cause of aging, combined with physiologic and environmental factors as harsh cleanser/soap, hot water bathing contributes to destroy barrier function susceptibility to xerosis (12). Thus, expert opinion guides

recommendations management of xerosis and pruritus by bathing not hot water, avoid harsh soap and apply moisturizers twice daily after any bathing.

For factor water intake and skin hydration, our study showed that drinking water less than 8 glasses/day, 200ml/glass worsened of xerosis in participants. A systemic review, Akdeniz M et al (70) found five studies that there was a positive association between fluid intake and SC hydration but no associations between TEWL; three studies reported a daily water intake of 2 L for 30 days showed an increase in both SC and deep skin hydration. One study reported daily water intake 1 L per day for 42 days, the last was not mention the amount of fluid intake. Nevertheless, mechanism of increase fluid intake increased stratum corneum hydration was still unclear. Cause of mostly water part in the body at the dermis, it might be the absorption water content from the dermis to the epidermis or false sensitivity of SC hydration device to detect dielectric constant of water in soft tissue (88).

For unexpected results, we were not found to be significantly associated with eczema and xerosis in middle-aged and elderly. It could be explained that the number and percentage of eczema cases in our participants is lower than the statistically significant calculations the same as allergic disease. Another factor that assumes a strong association with the development of aging and following xerosis is sun exposure. Skin aging involves intrinsic and extrinsic such as ultraviolet (UV) radiation. Physiological changes in aged skin caused xerosis was to reduce water content, decrease the number of lipids, decrease the NMF level, a deficit the aquaporin-3 receptor which regulates the passage of glycerol and water to maintain glycerol in the cornified envelope. (7, 12-14, 20). However, this factor was not a significant association with xerosis. Our demographic data showed the history of sun exposure; 54/163. Exposure of short duration of exposure per day; less than an hour(~15-30 minutes) (N=6), 1-2 hrs. (N=35), longer than 2 hrs. (~3 hrs.) (N = 13) and the timing variable from 8.00 AM -9.00 AM, 11.00 AM-12.00 AM and 5.00 PM-6.00 PM, thus making it difficult to be significant for it. It is a challenge for future studies to investigate the duration and timing of sun exposure associated with xerosis.

Surprising part of skincare knowledge and demographics of skin dryness (Table6.12). The situation showed nearly half of Thai people in middle-aged and geriatrics misunderstand thinking that bar soap is a good choice for their skin, only 8 percent think correct to choose pH5 wash. It reflected Thai people's values among the aged. It could explain by; 1. Thai aging population who still are old generation and old knowledge positive ideas about bar soap; 2. Easier available and using; bar soap is easier to used and rinse off than liquid soap; 3. Low price when compared with liquid soap / pH 5 wash product. Thai healthcare professionals need to educate Thai people about skincare knowledge to reduce the prevalence of xerosis in Thai geriatric in the future.

Limitations in our study were inevitable recall bias from participants retrospective thinking in questionnaire answering. Random error incidentally occurs in our sample size. The optimistic thinking, we can access the risk associate in terms of severity of skin dryness for avoiding it. All measurements attempt to follow the EEMCO guidelines in non-clinical settings, however, the temperature room in the study difficulty to control; it showed 21±2 °C, humidity 40-60 %. We prevented non-response bias by using Google form, questionnaire, checkboxes yes/no questions, specific wording, in addition to command descriptions and requirement setting. The requirement setting will force the surveyees to have to answer the question before submission. The strengths of this current study are the first epidemiology survey starting in middle-aged and conducting in general Thai population. Also, the study uses both subjective and objective assessment to identify the skin dryness including use the correlation analysis to select the proper investigate skin dryness. Forward and stepwise selection approaches in univariate and multivariate survey logistic regression models were created to explore the risk associated in this study.

CHAPTER 8
CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

High prevalence of xerosis in Thai middle-aged and elderly. Predicting xerosis might be the problem in earlier age in general Thai population. The physiologic aging of skin, lifestyle factors could play a role of skin dryness.

8.2 Recommendations

Understanding the prevalence and factors associated with xerosis severity helps healthcare professionals become aware not only of the patients but also of the general people who nominate starting aging. Advise the general or their patient to prevent risk progression of skin dryness should do.

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APPENDICES

APPENDIX A

CASE RECORD FORM

แบบบันทึกผู้เข้าร่วมงานวิจัย

No.....

อายุ.....ปี

เพศ ☐ ชาย ☐ หญิง ☐ อื่น ๆ น้ำหนัก.....ส่วนสูง.....(BMI.....)

เชื้อชาติ ☐ ไทย ☐ ไทย-จีน ☐ ไทย-อเมริกัน ☐ อื่น ๆ.....

อาชีพ

☐ เกษียณ ถ้ามี อาชีพก่อนเกษียณ

☐ เกษตรกร ☐ ช่างฝีมือ ☐ แม่บ้าน พ่อบ้าน

☐ ค้าขายในตลาด/กลางแจ้ง ☐ พนักงานนอกออฟฟิต ☐ ค้าขายในห้าง

☐ พนักงานโรงงาน ☐ พนักงานนั่งในออฟฟิต ☐ ข้าราการ

☐ นักกีฬา ☐ อื่น ๆ โปรดระบุ.....

หมายเหตุ: - ข้อมูลของท่านจะเป็นความลับ ไม่ถูกนำไปเปิดเผยเป็นรายบุคคลต่อผู้ใดทั้งสิ้น

- ในแบบสอบถามด้านล่างคำว่า “ผื่น” หมายถึง “บริเวณที่มีอาการแดงคัน”

โรคประจำตัว			
	ไม่มี	มี	
เบาหวาน	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
ความดันโลหิตสูง	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี

			ยาที่ได้รับการรักษา .....
ไขมันในเลือดสูง	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
หอบหืด	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
โรคภูมิแพ้ ☐ภูมิแพ้จมูก ☐ภูมิแพ้ขึ้นตา ☐ภูมิแพ้ผิวหนัง	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
ไต	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
ผื่นผิวหนังอักเสบเซ็บเดิร์ม	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
	ไม่มี	มี	
ผื่นผิวหนังอักเสบเซ็บเดิร์ม	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....

ผื่นสะเก็ดเงิน	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
โรคมะเร็ง	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
โรคไทรอยด์	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
โรคประจำตัว อื่นๆ โปรดระบุ.....	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา ..... ☐ ....ไม่ทราบ
ท่านเคยมีประวัติ แพ้ยาหรือไม่	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา ..... ☐ ....ไม่ทราบ
ท่านเคยมีประวัติ ดื่มเหล้าสุราหรือไม่	☐	☐	☐ เคย ดื่ม..... เลิกมา .....ปี ระยะเวลาที่ดื่ม.....ปี ☐ เลิกดื่ม ☐ นานๆ ครั้ง ☐ บ่อย โปรดระบุความถี่(ครั้ง/สัปดาห์)... .....

	ไม่มี	มี	
ท่านเคยมีประวัติ สูบบุหรี่หรือไม่	☐	☐	☐ เคยสูบ ..... เลิกมา .....ปี ระยะเวลาที่สูบ.....ปี ☐ สูบอยู่..... เฉลี่ย..... มวน / วัน เป็นเวลา .....ปี
ท่านทานชา กาแฟ เป็นประจำ	☐	☐	ถ้ามีโปรดระบุ.....(แก้ว/วัน) เป็นเวลา .....ปี
คำถามก่อนเกี่ยวกับ ความรู้ เรื่องการดูแลผิว			
	ไม่ใช่	ใช่	
ท่านคิดว่าผลิตภัณฑ์ที่ใช้อาบน้ำควรจะเป็นชนิดไหน	-	-	☐ สบู่ก้อน ☐ สบู่เหลว ☐ สบู่เหลวที่มีค่าความเป็นกรดอ่อนๆ ☐ อะไรก็ได้
ท่านคิดว่า การอาบน้ำ บ่อยมากกว่า 2 ครั้ง ต่อวัน เพิ่มความชุ่มชื้นให้กับผิวหนัง ลดอาการคันที่ผิวหนัง	☐	☐	
ท่านคิดว่าเวลา อาบน้ำควรจะใช้แปรง/ใยขัดผิวตัว ทำความสะอาดผิวหนัง	☐	☐	
ท่านคิดว่าหลัง อาบน้ำ ควรจะรีบทาครีมบำรุงผิว	☐	☐	

ประวัติส่วนตัวหรือครอบครัวที่เกี่ยวกับภูมิแพ้			
	ไม่มี	มี	
ท่านเคยมี อาการคันที่ผิวหนัง เรื้อรังไม่หายหรือไม่	☐	☐	ถ้ามีโปรดระบุ ☐ คันโดยไม่มีผื่นอักเสบผิวหนัง หรือ ☐ คันโดยมีผื่นอักเสบผิวหนัง ระยะเวลาที่เป็น..... ปี
ท่านเคยมีปัญหา ผิวแห้งผื่นรอยแดง คันที่ผิวหนัง ในระหว่างวัยเด็กหรือวัยรุ่น	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่เป็น..... ปี ยาที่ได้รับการรักษา .....
ท่านเคยมีประวัติคนในครอบครัวเป็นโรคภูมิแพ้ผิวหนังหรือไม่	☐	☐	ถ้ามี โปรดระบุ ☐ พ่อ ☐ แม่ ☐ พี่สาว/ น้องสาว ☐ พี่ชาย/น้องชาย ☐ ลูกสาว ☐ลูกชาย ☐ ปู่ ☐ ย่า ☐ ตา ☐ ยาย
ท่านทานยารักษากลุ่มยาลดไขมันในเลือด หรือ ยาทานวิตามินเอ หรือไม่	☐	☐	ถ้ามี โปรดระบุ ระยะเวลาที่ทาน..... ☐ เคยทาน โปรดระบุ ระยะเวลาที่ทาน.....
ท่านกำลังทายารักษาอาการผิวแห้งอยู่ก่อน หรือไม่	☐	☐	ถ้ามี โปรดระบุ ยาที่ใช้.....
ท่านประจำเดือน หมด หรือยัง	-	-	☐ ยังมีประจำเดือน ☐ประจำเดือนหมด โปรดระบุ ประจำเดือนหมด เมื่อ อายุ.....ปี เป็นเวลา .....ปี

			☐ ทานยาฮอร์โมนหลังประจำเดือนหมด ☐ไม่ได้ทานยาฮอร์โมนหลังประจำเดือนหมด
	ไม่ใช่	ใช่	
ท่านทานวิตามินเสริมเหล่านี้หรือไม่ ■ น้ำมันปลา ■ น้ำมันดอกทานตะวัน ■ น้ำมันดอกคำฝอย ■ น้ำมันEvening Primrose ■ น้ำมันรำข้าว ■ น้ำมันมะพร้าว ☐ ทานวิตามินเสริม อื่นๆ โปรดระบุ.....	☐ ☐ ☐ ☐ ☐ ☐	☐ ☐ ☐ ☐ ☐ ☐	
คำถามเกี่ยวกับการใช้ชีวิตประจำวัน			
	ไม่ใช่	ใช่	
ท่าน ใช้สบู่ก้อนอาบน้ำหรือไม่	☐	☐	ถ้าใช่ โปรดระบุ ยีห้อ สบู่.... ☐..ลักซ์....☐..เซฟการ์ด....☐ อาเซฟโซ ☐ เบนเนท....☐ นกแก้ว ☐ โดฟ... ☐ แคร์ ☐ โปรเทค..☐ เดทตอล. ☐ มาดามเฮง ☐ อื่นๆ โปรดระบุ .....
ท่าน ใช้สบู่เหลวอาบน้ำหรือไม่	☐	☐	ถ้าใช่ โปรดระบุ ยีห้อ สบู่.... ☐.ลักซ์ .....☐ เซฟการ์ด....☐ อาเซฟโซ. ☐เบนเนท... ☐ นกแก้ว ☐ โดฟ... ☐ แคร์ ☐ โปรเทค☐เดทตอล..

			☐.จอห์นสัน แอนด์ จอห์นสัน ☐.เบบี้ มายด์ ☐ ยูเซอรีน ☐ อื่นๆ โปรดระบุ .....
ท่านใช้น้ำยาฆ่าเชื้อโรคอาบน้ำหรือไม่	☐	☐	
ท่าน ใช้ ใยขัดตัว/แปรง ขัดถูผิวหรือไม่	☐	☐	
ท่านอาบน้ำบ่อย > 1 ครั้ง/วัน หรือไม่	☐	☐	ถ้ามีโปรดระบุ จำนวนครั้ง อาบน้ำ/วัน ☐1 ครั้ง/วัน ☐ 2 วัน ☐ 3 วัน ☐ >3 วัน
ท่านอาบน้ำเป็นเวลานาน หรือไม่	☐	☐	อาบน้ำนาน เป็นเวลา กี่ นาที โปรดระบุ ☐1-5 นาที ☐ 5-10 นาที ☐10-15นาที ☐ นาน > 15 นาที
ท่านแช่อ่างอาบน้ำเวลาอาบน้ำ	☐	☐	ถ้ามีโปรดระบุ ☐ 1-2 ครั้ง/สัปดาห์ ☐ > 2 ครั้ง/สัปดาห์
ท่านอาบน้ำร้อน/น้ำอุ่น	☐	☐	โปรดระบุ จำนวนครั้ง / สัปดาห์ ..... ครั้ง/สัปดาห์
ท่านใช้แป้งโรยทาผิวหลังอาบน้ำหรือไม่	☐	☐	
ท่านใช้น้ำหอมหรือครีมที่มีกลิ่นหอมทาตัว	☐	☐	
ท่านได้ใช้ครีมบำรุงผิว/ครีมให้ความชุ่มชื้นผิว	☐	☐	▪ จำนวนที่ใช้

			☐ ใช้ครีมทาบำรุงผิว < 2 ครั้ง/วัน ☐ ใช้ครีมทาบำรุงผิว ≥ 2 ครั้ง/วัน ■ การทา ☐ ใช้หลังอาบน้ำทันที ☐ ใช้ระหว่างวัน ☐ ใช้ก่อนนอน
ระหว่างวันท่านอยู่ในห้องปรับอากาศ	☐	☐	โปรดระบุ.....(ชั่วโมง/วัน)
เวลาเหงื่อออก ท่านรู้สึกมีอาการคันผิวหนังมากกว่าปกติ	☐	☐	
ระหว่างวันท่านดื่มน้ำ กี่ แก้ว/วัน (แก้วละ 200 มิลลิลิตร)	-	-	โปรดระบุ.....(แก้ว/วัน)
คำถามเกี่ยวกับการโดนแสงแดด			
	ไม่ใช่	ใช่	
ท่านทำกิจกรรมกลางแจ้ง/ออกแดด กี่ ชั่วโมง/วัน	☐	☐	โปรดระบุ.....(ชั่วโมง/วัน) เวลาที่ ออกแดด (กี่โมง - กี่โมง).....
ท่านใส่เสื้อผ้า กางเกง/กระโปรงขายาว ระหว่างออกนอกบ้าน/ออกแดด	☐	☐	
คำถามเกี่ยวกับการรบกวนการใช้ชีวิตประจำวัน			
	ไม่ใช่	ใช่	
ท่านคิดว่า อาการผิวแห้งของท่านในสัปดาห์ที่ผ่านมาทำให้ท่านรู้สึกคัน หรือ แสบผิวหนัง	☐	☐	ถ้า ใช่..โปรดระบุ ☐ มากที่สุด ☐ มาก ☐ น้อย ☐ ไม่รู้สึก
ท่านทีอาการคันผิวหนังช่วงเวลาใด	-	-	☐ เช้า ☐ กลางวัน ☐ เย็น ☐ ก่อนนอน

แบบสอบถามวัดคุณภาพชีวิตของผู้ป่วย

หมายเหตุ: - ข้อมูลของท่านจะเป็นความลับ ไม่ถูกนำไปเปิดเผยเป็นรายบุคคลต่อผู้ใดทั้งสิ้น

- ในแบบสอบถามด้านล่างคำว่า “ผื่น” หมายถึง “บริเวณที่มีอาการแดงคัน”

จุดประสงค์ของแบบสอบถามนี้ เพื่อประเมินว่า ผื่นผิวหนังทำให้เกิดปัญหากับคุณมากน้อยเพียงใดในช่วงหนึ่งสัปดาห์ที่ผ่านมา? **กรุณาตอบคำถามโดยทำเครื่องหมาย ✔ ลงในช่องทางขวามือ (ขอความกรุณาตอบคำถามทุกข้อ)**		
1. ช่วงสัปดาห์ที่ผ่านมา คุณมีอาการคัน, เจ็บ, ปวด, หรือปวดเสียว ที่ผิวหนัง มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	
2. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้คุณรู้สึกอับอาย, ขาดความมั่นใจ มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	
3. ในช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้คุณมีปัญหาในการออกจากบ้าน ไปซื้อสินค้า, ดูแลบ้าน หรือดูแลสวน มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
4. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังของคุณ มีผลกระทบต่อการเลือกเสื้อผ้าที่จะสวมใส่ มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
5. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังของคุณ มีผลกระทบต่อการเข้าสังคม หรือต่อการทำกิจกรรมในยามว่าง มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
6. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังมีผลกระทบต่อการเล่นกีฬา การออกกำลังกายของคุณ มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
7. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังของคุณ ทำให้คุณไม่สามารถทำงานหรือเรียนหนังสือได้หรือไม่? ถ้า “ไม่มี” ในช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้มีคุณมีปัญหาในการทำงาน หรือ การเรียน มากน้อยเพียงใด	มี ☐ ไม่มี ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐

8. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังของคุณ ได้สร้างปัญหาให้กับคู่ครอง หรือญาติหรือเพื่อนสนิท มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
9. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้คุณมีปัญหาในการมีเพศสัมพันธ์ มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
10. ช่วงสัปดาห์ที่ผ่านมา การรักษาผื่นผิวหนังก่อให้เกิดปัญหาแก่คุณ มากน้อยเพียงใด เช่น ทำให้คุณปล่อยบ้านเลอะเทอะ, การรักษาทำให้เสียเวลา เป็นต้น	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
จุดประสงค์ของแบบสอบถามนี้ เพื่อประเมินว่า ผื่นผิวหนังทำให้เกิดปัญหากับคุณมากน้อยเพียงใดในช่วงหนึ่งสัปดาห์ที่ผ่านมา? **กรุณาตอบคำถามโดยทำเครื่องหมาย ✔ ลงในช่องทางขวามือ (ขอความกรุณาตอบคำถามทุกข้อ)**		
1. ช่วงสัปดาห์ที่ผ่านมา คุณมีอาการคัน, เจ็บ, ปวด, หรือปวดเสียว ที่ผิวหนังมากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	
2. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้คุณรู้สึกอับอาย, ขาดความมั่นใจ มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	
3. ในช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้คุณมีปัญหาในการออกจากบ้านไปจับจ่ายซื้อสินค้า, ดูแลบ้าน หรือดูแลสวน มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
4. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังของคุณ มีผลกระทบต่อการเลือกเสื้อผ้าที่จะสวมใส่ มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
5. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังของคุณ มีผลกระทบต่อการเข้าสังคมหรือต่อกิจกรรมในยามว่าง มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
6. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังมีผลกระทบต่อการเล่นกีฬา การออกกำลังกายของคุณ มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐

7. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังมีผลทำให้คุณขาดงานหรือขาดเรียนหรือไม่ ถ้า “ไม่มี” ในช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้มีคุณมีปัญหาในการทำงาน หรือ การเรียน มากน้อยเพียงใด	มี ☐ ไม่มี ☐	ไม่มีความเกี่ยวข้อง ☐
8. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังของคุณ ได้สร้างปัญหาให้กับคู่ครอง หรือญาติหรือเพื่อนสนิท มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
9. ช่วงสัปดาห์ที่ผ่านมา ผื่นผิวหนังทำให้คุณมีปัญหาในการมีเพศสัมพันธ์มากน้อยเพียงใด	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐
10. ช่วงสัปดาห์ที่ผ่านมา การรักษาผื่นผิวหนังก่อให้เกิดปัญหาแก่คุณ มากน้อยเพียงใด เช่น ทำให้มีการเปรอะเปื้อนในบ้าน, การรักษาทำให้เสียเวลา เป็นต้น	มาก ☐ ปานกลาง ☐ เล็กน้อย ☐ ไม่มีเลย ☐	ไม่มีความเกี่ยวข้อง ☐

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<u>การประเมินคะแนนของแบบสอบถาม</u>

- มาก คะแนนเท่ากับ3
- ปานกลาง คะแนนเท่ากับ2
- เล็กน้อย คะแนนเท่ากับ 1
- ไม่เลย คะแนนเท่ากับ 0
- ไม่เกี่ยวข้องคะแนนเท่ากับ0
- ไม่ได้ตอบ คะแนนเท่ากับ 0

คำถามในข้อที่ 7 ถ้า มี คะแนนเท่ากับ 3

เมื่อรวมคะแนนทั้งหมดแล้วคะแนนเต็มในแต่ละข้อเท่ากับ 3 น้อยสุดเท่ากับแบบสอบถามมีทั้งหมด10 ข้อ คะแนนรวมทั้งหมดสูงสุดเท่ากับ30 ต่ำสุดเท่ากับ 0

<u>การแปลความหมายของคะแนนที่ได้</u>

0-1 :ไม่มีผลลกระทบต่อชีวิตของผู้ป่วย

2-5 : มีผลกระทบเล็กน้อย

6-10 : มีผลกระทบปานกลาง

11-20 : มีผลกระทบอย่างมาก

21-30 :มีผลกระทบอย่างมากที่สุด

โดยกำหนดให้คนที่มีคุณภาพชีวิตอยู่ในเกณฑ์ดี คือ คนที่มีคะแนนอยู่ในช่วง 0-5

APPENDIX B
ETHICAL APPROVAL

Certificate of Approval

Human Research Ethics Committee of Thammasat University No.1 (Faculty of Medicine)

99/209 Moo 18, Paholyotin Road, Auphur Klongluang, Pathumthani, Thailand 12120,

Tel 662-9269704 and Fax 662-5644444 ext. 7535

Number of COA	056/2020
Title of Project	PREVALENCE AND ASSOCIATION FACTORS OF XEROSIS IN MIDDLE-AGED AND ELDERY IN THAI PEOPLE : A CROSS-SECTIONAL STUDY
Project No	MTU-EC-00-6-218/62
Principal Investigator	Isara Rojvutthikun , M.D. Sunatra Nitayavardthana, M.D.
Study Center	Thammasat University Hospital
Responsible Department	Chulabhorn International College of Medicine Thammasat University, Pathumthani, Thailand 12120 Tel. 095-3955445

Document Reviewed

1. Protocol Version 1 : dated November 18, 2019
2. Information sheet Version 3 : dated March 4, 2020
3. Consent form Version 2 : dated December 30, 2019
4. Case record form Version 2 : dated December 30, 2019

The Human Ethics Committee of Thammasat University No.1 (Faculty of Medicine) is in full compliance with international such as Declaration of Helsinki, The Belmont Report, CIOMS Guidelines and The International Practice (ICH-GCP).

This document is a record of review and approval / acceptance of a clinical study protocol. The Human Research Ethics Committee of Thammasat University No.1 (Faculty of Medicine) has approved the above study and the following documents for use in the study at the Expedited Review.

Approval period 1 year

Progress report deadline: March 18, 2021

Signed: .....

(Associate Professor Thana Khawcharoenporn, M.D.)

Secretary and Committee of the Human Research Ethics Committee of Thammasat University No.1

(Faculty of Medicine)

Signed: .....

(Associate Professor Walpoj Chanvimalueng, M.D.)

Chairman of the Human Research Ethics Committee of Thammasat University No.1

(Faculty of Medicine)

Date of Approval: March 19, 2020

Date of Expire: March 18, 2021

APPENDIX C
TIME FRAME

Schedule of Events	2019		2020		
	Oct-Dec	Jan-Mar	Apr-Jun	Jul-Sep	Oct-Dec
1. Research proposal					
2. Research ethics					
3. Experiment					
4. Data analysis					
5. Manuscript preparation					
6. Publication					

APPENDIX D
THESIS ADVISOR'S COMMENTS

This thesis can be completed within the time frame of Master of science course. The student had learned about research methodology and prevalence of dry skin among middle age and elderly populations. The result from this study will have some benefit for health promotion. However, to reflex the problem among Thai population, the larger study sample size should be done in the future.

Advisor: Sunatra Nitayavardhana, M.D.

BIOGRAPHY

Name	Miss Isara Rojvutthikun
Date of Birth	July 6, 1991
Educational Attainment	2018-present: Master of Science (Dermatology) Chulabhorn International College of Medicine, Thammasart University
	2010-2016: Doctor of Medicine Srinakharinwirot University
Work Experiences	2017-2018: Internship Prapokklao Hospital
	2016-2017: Internship Nanarong Hospital