EXPLORING THE RELATIONSHIP BETWEEN BODY MASS INDEX AND FACIAL CREASE AMONG ADULT FEMALE: A SCOPING REVIEW

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by

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for the degree of
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CERTIFICATE

This is to certify that the dissertation entitled EXPLORING THE RELATIONSHIP BETWEEN BODY MASS INDEX AND FACIAL CREASE AMONG ADULT FEMALE: A SCOPING REVIEW is the bona fide record of review work done by PUTERI NURUL HASSANAH ANUAR during the period from February 2020 to September 2020 under my supervision. I have read this dissertation and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation to be submitted in partial fulfilment for the degree of Master of Science (Forensic Science).

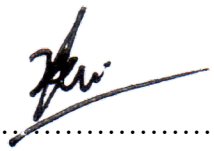
Supervisor,

…….

(DR. DIVYA A/P VANOH)

Date: 7 September 2020

Co – supervisor,



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(DR. HELMI HADI BIN MOHD. HADI PRITAM)

Date: 9 September 2020

DECLARATION

I hereby declare that this dissertation is the result of my own investigations, except where otherwise stated and duly acknowledge. I also declare that it has not been previously for concurrently submitted as a whole for any other degrees at Universiti Sains Malaysia or other institutions. I grant Universiti Sains Malaysia the right to use the dissertation for teaching, research and promotional purposes.

……..

(PUTERI NURUL HASSANAH ANUAR)

Date: 9 September 2020

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TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST ABBREVIATIONS

BMI	Body Mass Index
WHO	World Health Organisation
MC1R	Melanocortin 1 receptor
EE	Ethinyl Estradiol
NA	Norethindrone Acetate
AGE	Advanced Glycation End product

LIST OF SYMBOLS

r	linear correlation coefficient of a sample
P	Probability
SD	Standard Deviation
n	Sample size
N	Population size
kg/m^2	Kilogram per meter square

EXPLORASI PERKAITAN ANTARA INDEKS JISIM TUBUH DENGAN LIPATAN MUKA DALAM KALANGAN WANITA DEWASA: PENINJAUAN KAJIAN SEMULA

ABSTRAK

Kedalaman lipatan muka dan lokasi lipatan muka mungkin berbeza bagi setiap individu yang berlainan dimana ia boleh menjadi karakteristik unik bagi seseorang individu. Oleh itu, ini akan memberikan kesan pada proses pengenalan manusia untuk kes forensik. Kajian sebelum ini menyatakan bahawa individu kurus dan wanita berpotensi memiliki daya kepanjangan kulit yang lebih tinggi berbanding individu gemuk dan lelaki. Namun, tiada kajian membuktikan perhubungan antara indeks jisim badan dan lipatan muka. Dengan demikian, kajian ini bertujuan untuk mengkaji semula kajian lepas yang mengkaji perhubungan antara lipatan muka dan indeks jisim badan dalam kalangan wanita berusia 40 dan 60 tahun. Artikel telah dipilih menggunakan kaedah *PRISMA* dan pencarian melalui beberapa pangkalan data seperti *Google Scholar, Pubmed, Science Direct* dan *Wiley Online*. Sebanyak 20 artikel bertulis disertakan dan dianalisis. Penemuan mendedahkan bahawa indeks jisim badan dan kedutan muka boleh dihubung kaitkan, akan tetapi beberapa parameter lain perlu diambil kira seperti umur, cara hidup dan tahap pendedahan kepada matahari. Hal ini kerana, parameter ini adalah parameter yang lemah jika diambil kira bersendirian untuk mengaitkan kedutan muka dan penuaan kulit bersama indeks jisim badan. Selain itu, faktor intrinsik dan ekstrinsik juga perlu diambil kira dalam menganalisis kedutan muka dan penuaan kulit.

EXPLORING THE RELATIONSHIP BETWEEN BODY MASS INDEX AND FACIAL CREASE AMONG ADULT FEMALE: A SCOPING REVIEW

ABSTRACT

The depth of facial crease and location of the facial crease may differ among different individuals which makes it a unique characteristic of an individual; hence this may affect the human identification process for forensic cases. Previous studies stated that thin people and women tend to have higher skin extensibility as compared to those who are fat and men. However, no studies have proven the relationship between body mass index (BMI) and facial wrinkle. Thus, this study is to review the studies examining the association between facial crease and BMI among females aged 40 and 60 years old. Articles were selected using PRISMA guidelines and several mainstream databases, such as Google Scholar, PubMed, Science Direct and Wiley Online were searched. A total of 20 articles were finally included and analysed. Findings revealed that BMI is associated with facial wrinkles though other parameters such as age, lifestyle, and sun exposure need to be considered as well. This parameter alone is a weak parameter to relate the facial wrinkles and skin ageing with body mass index. Other than that, intrinsic and extrinsic factors also need to be considered in analysing facial wrinkles and skin ageing.

CHAPTER 1

INTRODUCTION

1.1 Background of Study

An ongoing process that involved declining in skin function and changes in its appearance is called skin ageing. This is a complex phenotype process that includes different features and facial creases are the most common and notable (Hamer *et al.*, 2017). Facial crease mentioned by Hadi and Wilkonson (2014) is "a line made by pressing, folding or wrinkling". Wrinkle is a smooth or slight ridge on the skin due to ageing. It is limited until the skin dermis and can be treated by cosmetic. Meanwhile fold formed due to intrinsic ageing, laxity of skin, bone loss or sagging due to gravity and furrow is a deep wrinkle on the skin such as on forehead area (Hadi and Wilkinson, 2014).

In 2001, Lemperle introduced a wrinkle score scale based on specific facial wrinkle based on photograph and profilometry classification with measurement of wrinkle depth. It is practically used by clinicians to treat patients (Lemperle *et al.*, 2001). Figure 1 shows the location of folds and wrinkles on the face. Body mass index (BMI) is a simple index of weight for height that is used in the assessment of nutritional status (Hausman *et al.*, 2011). According to World Health Organisation (WHO), underweight is less than 18.50 kg/m^2, the normal range is from 18.50 – 24.99 kg/m^2, overweight range is 25.00 – 29.99 kg/m^2, and obese is more than 30.00 kg/m^2 (Lee *et al.*, 2012). The medical field and public health indicate BMI as overall adiposity and as a prognostic predictor of disease. For example, obesity was said to be associated with chronic disease and other co-morbidities such as cardiovascular disease, diabetes mellitus, fatty liver and

many more. However, facial texture predicted about 3 – 10% of variation based on BMI (Mayer *et al.*, 2017).

Donofrio (2000) suggested that skin has its elasticity that when it contracts it will be back in shape at the face baseline. Younger people have firm and elastic skin despite fluctuating weight, while older individual tend to lose their skin elasticity with ageing. The skin of older adults will not contract at the face baseline with changes in weight (Donofrio, 2000). Previous studies mentioned that BMI is one of the factors for skin ageing and facial wrinkles (Raduan *et al.*, 2008; Ezure and Amano, 2010, 2012; Trojahn *et al.*, 2015).

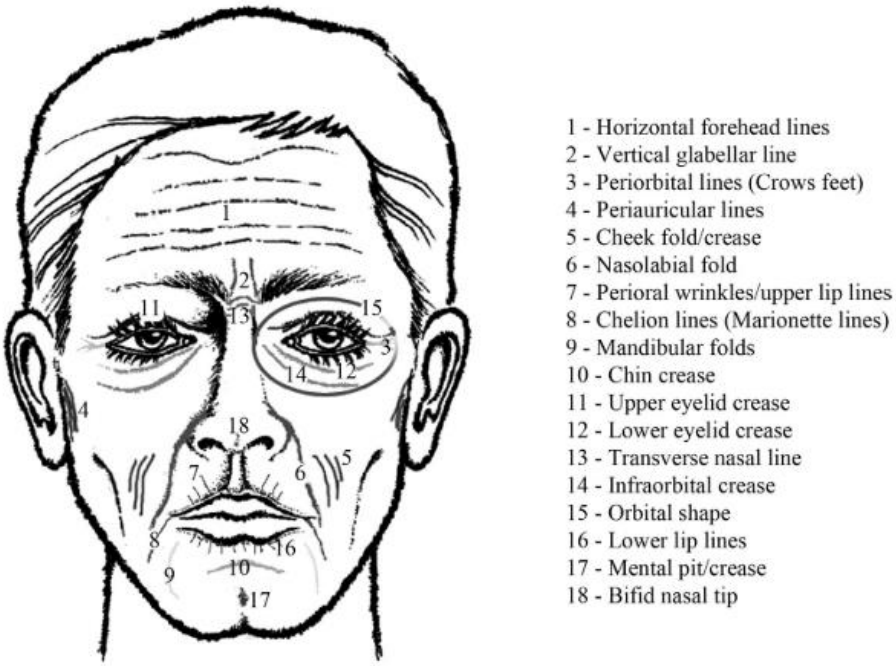

Figure 1.1 Location of folds and wrinkles on the face. Modified from Dunn and Harisson (Hadi and Wilkinson, 2014).

Appearance has always been an important factor for an individual in gaining confidence and quality of life, especially among females. Many not realised that other

than sun exposure – which is a common risk factor to facial changes, there are other risk factors such as smoking habit, lifestyle and body mass index (BMI). Thus, this study is conducted to give knowledge and awareness to the public. In the same time to establish the association between BMI and facial crease.

1.2 Objectives

1.3 1.2.1 General Objective

This study is to explore the relationship between Body Mass Index (BMI) and facial crease among adult female.

1.2.2 Specific Objectives

To determine factors causing facial creases among adult female.

1.4 Significance of Study and Problem Statement

Maintaining a youthful appearance is essential for a better quality of life. Most of the individuals are not aware of the risk factors of skin ageing due to the rise in the use of cosmetic products. Enhanced oxidative stress and poor dietary habits are among the factors responsible for the facial crease. On the other hand, variation in BMI is another factor influencing the facial feature of an individual. Establishing the relationship between facial crease and BMI is important in the field of evolutionary psychology and computational face recognition. Therefore, this study was conducted to establish the

association between facial crease and Body Mass Index (BMI) among adult female as well as to identify the risk factors contributing to facial crease. This study can provide knowledge and awareness on maintaining youthful skin appearance through a healthy lifestyle.

CHAPTER 2

LITERATURE REVIEW

2.1 Skin Anatomy

Skin is the largest organ in human that covered all body parts. Skin contributed 16% of total body weight. It consists of two main layers which are epidermis and dermis (*Anatomy of the Skin | SEER Training*, 2020). Below the dermis is the fatty layer, panniculus adiposus that designed as subcutaneous. This part is separated from the rest of the body by panniculus carnosus which is a layer of striate muscle. There are two kinds of human skin; glabrous skin that can be found on palm and sole. It has a grooved surface with unique configuration called dermatoglyphics. The second type of human skin is the hair-bearing skin which in contrary has hair follicle and sebaceous gland. It may vary between different body parts (Burns *et al.*, 2008). Figure 2.1 shows the anatomy of the skin.

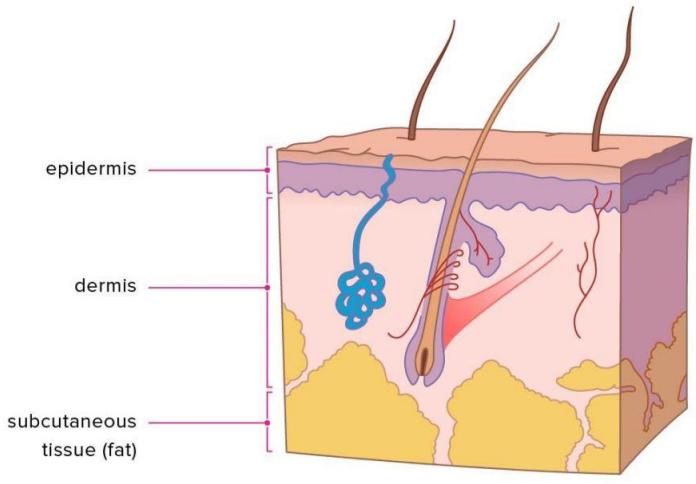

Figure 2.1 Anatomy of the skin (Source: healthline.com)

The epidermis is the outer layer of the human skin. It is a layer where physical visual such texture, colour and any deformity; scars can be seen. Its major cell is keratinocyte and terminally differentiated with stratified epithelium cell (Krizek *et al.*, 1997). Keratinocyte synthesizes keratin that functions as a protein that forms a chain of polypeptides linked between adjacent cysteine amino acid. The epidermis has four layers; stratum basal, stratum spinosum, stratum granulosum, stratum corneum (Venus *et al.*, 2010). Figure 2.2 showed the layers of the epidermis. Stratum basal is one thick cell but in glabrous skin. This is where its main cell type is keratinocyte. Stratum spinosum is a layer of polyhedral cells formed from the basal cell that move forward to the surface and it is connected by desmosome. Under a microscope, the layer showed a spine-like surface. Stratum granulosum is a layer where its keratinocyte has intracellular granules of keratohyalin. The cells release lipid components into the intercellular space that has barrier function and intercellular cohesion. Lastly, stratum corneum which is the uttermost layer of the matrix (Venus *et al.*, 2010).

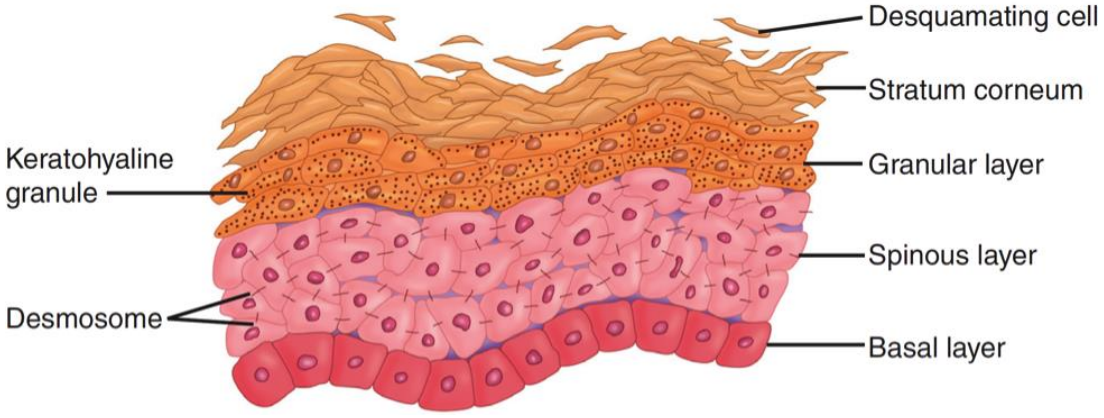

Figure 2.2 Layers of epidermis (Baumann, 2008).

The dermis is bonded externally with the epidermis and internally by subcutaneous fat by its junction. It is a tough, resilient layer that protects the body against

internal injury caused by chemical factors, and has a specialised structure (Venus *et al.*, 2010). Thus, the dermis is known as supporting matrix where polysaccharides and protein are linked and produce macromolecules to retain water. The protein that is associated within the layer are collagen with great tensile strength; and elastin that exists in small proportions (Tony Burns *et al.*, 2008). This layer contains blood vessels, nerve cells, sweat glands, sebaceous gland which secretes sebum for moist skin as well as hair follicles for maintaining body temperature (Krizek *et al.*, 1997).

2.2 Facial Creases

Facial creases is the most notable sign of skin ageing characterized by permanent lines related to connective tissue attachments with the underlying muscle fibres in the dermal layer of skin (Hamer *et al.*, 2017). Facial crease is a line made by pressing, folding or wrinkling (Hadi and Wilkinson, 2017). Other obvious age-related changes in the face are the wrinkle which are the expression lines formed due to ageing. It is limited until the dermis layer and can be treated by cosmetic surgery. Meanwhile, the fold is formed due to intrinsic ageing, laxity of skin, bone loss or sagging due to gravity and furrow is a deep wrinkle on the skin such as on the forehead area (Hadi and Wilkinson, 2014).

The human face has its baseline where it holds face skin. Donofrio (2000) suggested that skin has its elasticity that when it contracts it will be back in the shape of the face baseline. Younger people have firm and elastic skin despite fluctuating weight of gain or loss weight, while older individual tend to lose their skin elasticity with ageing. Skin of older adults will not contract to the face baseline with changes in weight

(Donofrio, 2000). This caused the skin to remain creased with the excess skin underlying fat area.

2.2.1 Type of Facial Crease

The formation of facial wrinkles was introduced in the 19th century as a diagnostic sign of illness. In the past study, an infraorbital crease or "oculozygomatic line" was thought as an indication for brain disease but it was indicated sexual organ disease or excessive masturbation in adult (Hilton, 1911). According to Hadi and Wilkinson (2014), wrinkles, furrows and fold were later introduced and used interchangeably with no general classification.

Wrinkles are fine lines on the skin surface and its limit only until dermis. This condition can be reversed by treatment. Meanwhile, the fold is a lapped over skin onto each other that is formed due to natural ageing or gravity. On other hand, the furrow is an obvious, rough wrinkle line that can be seen with naked eyes such lines on forehead (Sadick *et al.,* 2009). Figure 2.3 showed textural changes in facial skin, modified from Lemperle, 2001.

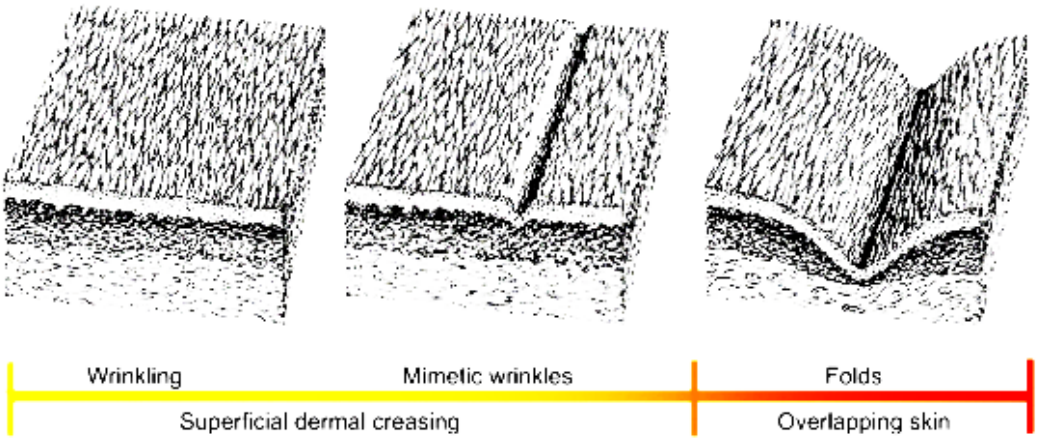

Figure 2.3 Textural changes of facial skin, modified from Lemperle, 2001 (Hadi and Wilkinson, 2017).

In 1996, Fitzpatrick introduced a scale to classify the perioral and periorbital wrinkles to establish the effect of laser resurfacing of the skin. The scale is generalized wrinkling and elastosis instead of wrinkle depth, however, wrinkle depth is an important measurement when considering augmentation of injection fillers on the face (Fitzpatrick, 1997). A modified wrinkling scale score was conducted in the same year by Glogau also generalized the wrinkle and do not mention any specific wrinkles or folds (Hadi and Wilkinson, 2017). He proposed a classification of wrinkles based on type I until type IV; type I – no wrinkle, type II – wrinkle in motion, type III – wrinkle at rest, type IV – only wrinkle (Glogau, 1996). Table 2.1 explained Fitzpatrick wrinkling scale.

Table 2.1 Fitzpatrick wrinkling scale (Source: Lemperle et al., 2001).

Class	Score	Wrinkling	Degree of Elastosis
I	1 – 3	Fine wrinkles	Mild (fine textural changes with subtly accentuated skin lines)
II	4 – 6	Fine to moderate depth wrinkles, moderate number of lines.	Moderate (distinct popular elastosis, individual papules with yellow translucency, dyschromia)
III	7 – 9	Fine to deep wrinkles, numerous lines, with or without redundant skin	Severe (mulitpapular, and confluent elastosis, thickened yellow and pallid cutis rhomboidalis)

Later in 1998, Hamilton then proposed the first classification of wrinkling scale score that include specific wrinkles; fine wrinkles, furrows and folds. His table of the score is more comprehensive and understandable to categorize the patient's problem (Hamilton, 1998). Table 2.2 explained Hamilton's classification of wrinkling scale score. Lemperle (2001) proposed a scale based on wrinkle depth as assessment for the skin to be used in the treatment of facial to specific wrinkles or furrows. The scale is clinically reliable and consistently used based on its photograph classification of specific wrinkles or furrows, and profilometry classification correlated with measurement of wrinkle depth (Lemperle *et al.*, 2001). Table 2.3 showed Lemperle's classification of facial wrinkle.

Table 2.2 Hamilton's classification wrinkling scale score (Source: Hamilton, 1998).

Facial ageing	Clinical morphology	Tissue location	Clinical location	Aetiology	Optimal treatment
A	Folds	Muscular	Nasolabial folds, neck, eyelids	Loss of tone, gravity	Rhytidectomy, blepharoplasty
B	Furrows	Musculocutaneous	Forehead, smile lines	Repeated facial expressions	Filler substances, injectables, implants
C	Wrinkles	Cutaneous	Cheeks, crow's feet, perioral	Intrinsic ageing, photoageing	Resurfacing, laser, chemical peel
D	Combination				Combined approach

Table 2.3 Lemperle's classification of facial wrinkle (Source: Lemperle et al., 2001).

Facial wrinkle	Class	Description
Horizontal forehead lines	0	No wrinkles
Glabellar frown lines Periorbital lines Preauricular lines	1	Just perceptible wrinkle
Cheek lines Nasolabial folds	2	Shallow wrinkles
Radial upper lip lines Radial lower lip lines	3	Moderately deep wrinkle
Corner of the mouth lines Marionette lines	4	Deep wrinkle, well-refined edges
Labiomental crease Horizontal neck folds	5	Very deep wrinkle, redundant fold

2.2.2 Factors Affecting Facial Crease

As mentioned by Hadi and Wilkinson, (2014) skin ageing is influenced by the intrinsic and extrinsic factors. Intrinsic factor is a natural structural change in the skin due to genetic or ageing. However, the intrinsic skin ageing can also be influenced by extrinsic factors such as smoking, use of skincare or exposure to the sun. Age estimation based on facial skin must be done based on multiple recognized analysis and must not be solely done based on one parameter only (Guinot *et al.*, 2002).

The review by Farage *et al.* (2008) demonstrated that intrinsic factors include ethnicity, anatomical variations and hormonal changes in cutaneous tissues. Meanwhile, extrinsic factors are lifestyle parameters such as smoking and sun exposure. In general, according to ethnicity (African - American, Caucasian, Asian) the African - American has the healthiest skin with a high level of pigmentation. This aids in the protection of the skin from sun exposure. They also have the most compact skin structure and high levels of cellular lipid content as compared to both Caucasian and Asian which helps in slowing down skin ageing.

In addition to that, the skin of Asian population is healthier as compared to Caucasian based on studies by Martini *et al.* (2004) and Sudel *et al.* (2005). Skin remains elastic and rigid due to the presence of collagen and estrogen (Haydont *et al.*, 2019) but these will decrease as individual age or with hormonal changes (Paes *et al.*, 2009). Besides that, the skin structure is affected by extrinsic factors such as smoking, dietary intake and weight (Ernster *et al.*, 1995; Paes *et al.*, 2009; Wolff *et al.*, 2011). The hormonal changes can be observed among females especially after menopause as there

will be a sudden decrease the in the estrogen levels and this will slow down the healing process on the skin (Farage *et al.*, 2008).

2.3 Body Mass Index (BMI)

BMI according to the World Health Organization (WHO) is assessing a person's nutritional status and it also correlates with a person's risk of chronic diseases such as cardiovascular diseases and diabetes. It is defined as a person's weight in kilograms divided by the square of the person's height in metres (kg/m2). The median body mass index for an adult population should be in the range of 21 to 23 kg/m2, while the goal for individuals should be to maintain body mass index in the range of 18.5 to 24.9 kg/m2 (*WHO/Europe | Nutrition - Body mass index - BMI*, 2020). Table 2.4 indicated the nutritional status according to the BMI score.

Facial ageing is correlated with BMI. Several studies had proven the correlation between BMI and facial ageing especially wrinkling formation. The previous study has shown that there is a statistically significant correlation between BMI and wrinkling or ageing, however, it is a weak relationship and there is a stronger determinant in wrinkling and ageing (Guinot *et al.*, 2002; Ekiz *et al.*, 2012; Hamer *et al.*, 2017). Meanwhile, in a study by Wolff *et al*. (2011) and Rexbye *et al*. (2006), the association between BMI and wrinkling or ageing are influenced by other confounding factors such as diet, exposure to sunlight and use of skincare.

Table 2.4 Nutritional status classification based on BMI (adapted from WHO 1998).

BMI (kg/m²)	**Nutritional status**
Below 18.5	Underweight
18.5–24.9	Normal weight
25.0–29.9	Pre-obesity
30.0–34.9	Obesity class I
35.0–39.9	Obesity class II
Above 40	Obesity class III

2.3.1 Factors Influencing Body Mass Index

The rate changes of BMI during adolescence to young adulthood was influenced by genetic (Lajunen *et al.*, 2009). However, the genetic heritably factors that influence BMI might be altered by an environmental factor or socio-demographic status of an individual. Environmental factors comprised of lifestyle, dietary intake, alcohol consumption, smoking status and physical activity. Meanwhile, socio-demographic status was measured based on individual age group, education level, salary, marital status, and location of residence.

Genetically women have a higher percentage of overweight and obesity cases as compared to men. In fact, Levesque *et al.* (2011) finding that also stated in World Health's Organisation 40% of women are overweight and obese worldwide (Levesque, 2011). Hence, this gives a strong justification towards the finding by Mustelin (2009) that stated that genetic factor and sex-specific genetic was significantly correlated with BMI and waist circumstance (Mustelin *et al.*, 2009).

At age range 16 – 24 years old, BMI increase due to additive genetic factor. And slow rate changes at age 18 was due to genetic factor, where boys has higher BMI compared to girls (Ortega-Alonso *et al.*, 2012). Supported by several previous studies which state genetic factors contribute in the increment of rate changes of BMI in male and female especially during adolescence phase and gradually decrease after 60 years old or above (Sundquist and Johansson, 1998; Sattar *et al.*, 2013; Chang and Choi, 2015).

Environmental factors also influenced BMI of an individual, in the study by Chang and Choi (2015) found that lack of physical activity caused increased BMI in both men and women (Chang and Choi, 2015). Apart from that, smoking status and alcohol consumption are also among the common environmental factors measured. Active smokers have BMI more than 30 kg/m² (obese) as compared to a non-smoker or former smoker regardless of gender (Sattar *et al.*, 2013). Besides that, alcohol consumption also gives positive correlation, where BMI increases with frequent alcohol intake (Chang and Choi, 2015).

The previous study also demonstrated the correlation between BMI and socioeconomic factor. Data from Sattar *et al.* (2013) found that individuals with good socioeconomic status have higher BMI as compared to those with lower income. Besides that, individuals who live in a rural area have lower BMI as compared to those who are living in an urban area. This might because of the luxury of able to have healthy food and enough nutrition (Sattar *et al.*, 2013).

2.4 Effect on Skin Ageing

2.4.1 Smoking

Smoking has a strong correlation with skin ageing. The study carried out by Kennedy *et al.* (2003) showed a correlation between smoking and formation of elastosis. Elastosis is a condition where there are changes in dermal tissues losing its elastin material. Formation of elastosis due to smoking appeared significant among the younger age group as compared to the older group aged 60 years and above (Kennedy *et al.*, 2003).

In a review, smoking is an independent risk factor for skin ageing (Landau, 2007). A complex facial wrinkle was present on the area of periorbital; obvious crow's feet. Main facial wrinkle features on both men and women smokers are fine wrinkles on the perioral area (Daniell, 1971). The correlation between smoking and wrinkling measured based on the number of cigarette packet smoked. A heavy smoker has more wrinkles compared to non-smoker (Landau, 2007).

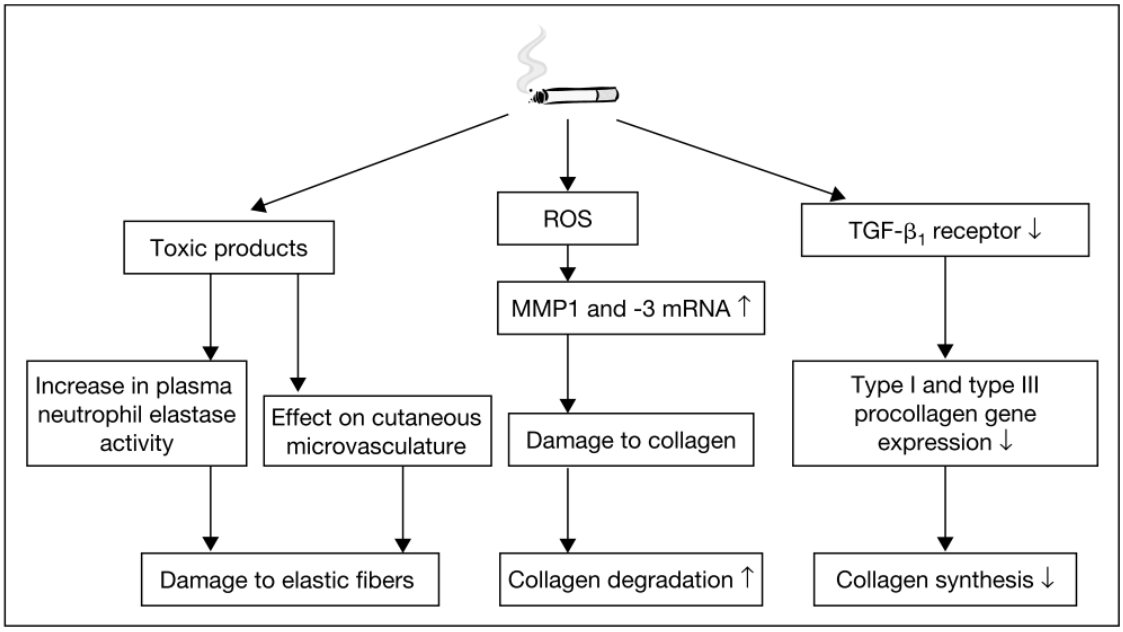

Figure 2.4 The effects of smoking on the skin (Source: Landau, 2007).

In Figure 2.4 demonstrate mechanism on the effect of smoking on the skin. Smokes from cigarettes contain a toxic product that later increases plasma neutrophil elasticity activity which would causes damage to the elastin material. On the other hand, cigarettes smoke also affect cutaneous microvasculature and this condition is usually faced by cardiovascular patients. On molecular aspects, reactive oxygen species were believed to contribute in wrinkling among smokers. This cellular damage causes disturbance in metabolism and thus resulting in collagen degradation and low collagen synthesis (Landau, 2007).

2.4.2 Sun Exposure and Protected Skin

Sun exposure is one of the risk factors from environment. It could be from the ultraviolet radiation, visible light radiation and infrared radiation. Ultraviolet radiation is commonly exposed on human skin (Krutmann *et al.*, 2017). This radiation on skin causes specific molecular response that would damage skin matrix and connective tissue.

Ultraviolet radiation damage skin collagen matrix by initiating collagen degradation and slower its synthetisation. The main mechanism that lead to this destruction is when reactive oxygen species are generated (Landau, 2007).

Ultraviolet radiation of all wavelength affects all layers of skin namely the epidermis, dermis and hypodermis. Skin exposed to the sun radiation undergoes oxidation (generate reactive oxygen species) that lead to activation of intracellular kinases. Activated kinase stimulate activation of transcription factor and nuclear transcription factor such as activated protein (Landau, 2007). The activation of these two transcription factors lead to collagen inhibition and degradation (Krutmann *et al.*, 2017). However, this condition can be prevented by applying topical antioxidants due to its ability to slow the production of collagenase.

2.4.3 Nutrition

As the proverb "you are what you eat" (Martin, 2016), nutrition intake can either be able to prevent or even increase the rate of wrinkle formation (Pezdirc *et al.*, 2015; Krutmann *et al.*, 2017). Antioxidant vitamins consumption may delay the rate of ageing. A review stated that high intake of vitamin C is associated with lower wrinkles formation, while high intake of fat and carbohydrate increase the wrinkles formation (Latreille *et al.*, 2012; Krutmann *et al.*, 2017).

On the other hand, taking too much sugar was assumed to be associated in the formation of wrinkles. This is due to the glycation process where sugar binds with protein in the bloodstream. The process lead to the formation of a harmful advanced glycation

end product (AGE) (Krutmann *et al.*, 2017) which lead to the formation of wrinkles (Gkogkolou and Böhm, 2012).

In different study, a severe skin ageing (wrinkling) is due to the lower recommended intake of monounsaturated fatty acid such as oil especially olive oil. From the finding high intake of monounsaturated fatty acid provided by vegetables oil lower the formation of wrinkles (Latreille *et al.*, 2012). Previous study stated olive oil has high amount of specific fatty acid profile with high amount of monounsaturated fatty acid and low ratio of polyunsaturated fatty acid (Viola and Viola, 2009). Hence, increase the amount of monounsaturated fatty acid in epidermis which lead to lower the possibility of oxidative damage (Purba *et al.*, 2001). In contrast with the result intake of monosaturated fatty acid from dairy product, meat and process meat which present no association with wrinkle formation (Latreille *et al.*, 2012).

CHAPTER 3

METHODOLOGY

3.1 Search Strategy

The articles were searched using several databases such as Google Scholar, PubMed, Science Direct and Wiley Online. The keywords used for searching the articles were “facial wrinkle”, “facial crease”, “weight”, “body mass index”, and “skin ageing”. Articles obtained were exported into Mendeley library to remove for duplicates.

3.2 Inclusion Criteria

Facial crease resulted from the process of folding, sagging and wrinkling of the skin. In this review, any studies related to facial crease such as facial wrinkle, skin wrinkle, or skin ageing among adult or older women were included. Meanwhile, articles discussing the association between BMI or body weight with facial crease or skin ageing were included. Only studies published in English and Malay language were included in this review.

3.3 Exclusion Criteria

Studies that reported on facial crease among men, teenagers or human cadaver were excluded from this review.

3.4 Study Selection

The prime literature search was executed by the author. All the duplicates articles were filtered using software followed by manual filtration to verify that no duplicate articles were included. Relevant studies were chosen by screening its title, abstract and retrieval of the full article from the database search. Any irrelevant studies were rejected based on the inclusion and exclusion criteria. Full text papers were downloaded and assessed for eligibility.

3.5 Data Organisation and Reporting

All the information from the reviewed studies were summarized in a table according to its author's name, year of publication, study or subject description, parameters used and the findings of the study. The studies were reported according PRISMA guideline http://www.prisma-statement.org/statement.htm (Moher *et al.*, 2009). Figure 3.1 showed the article search and selection strategy.

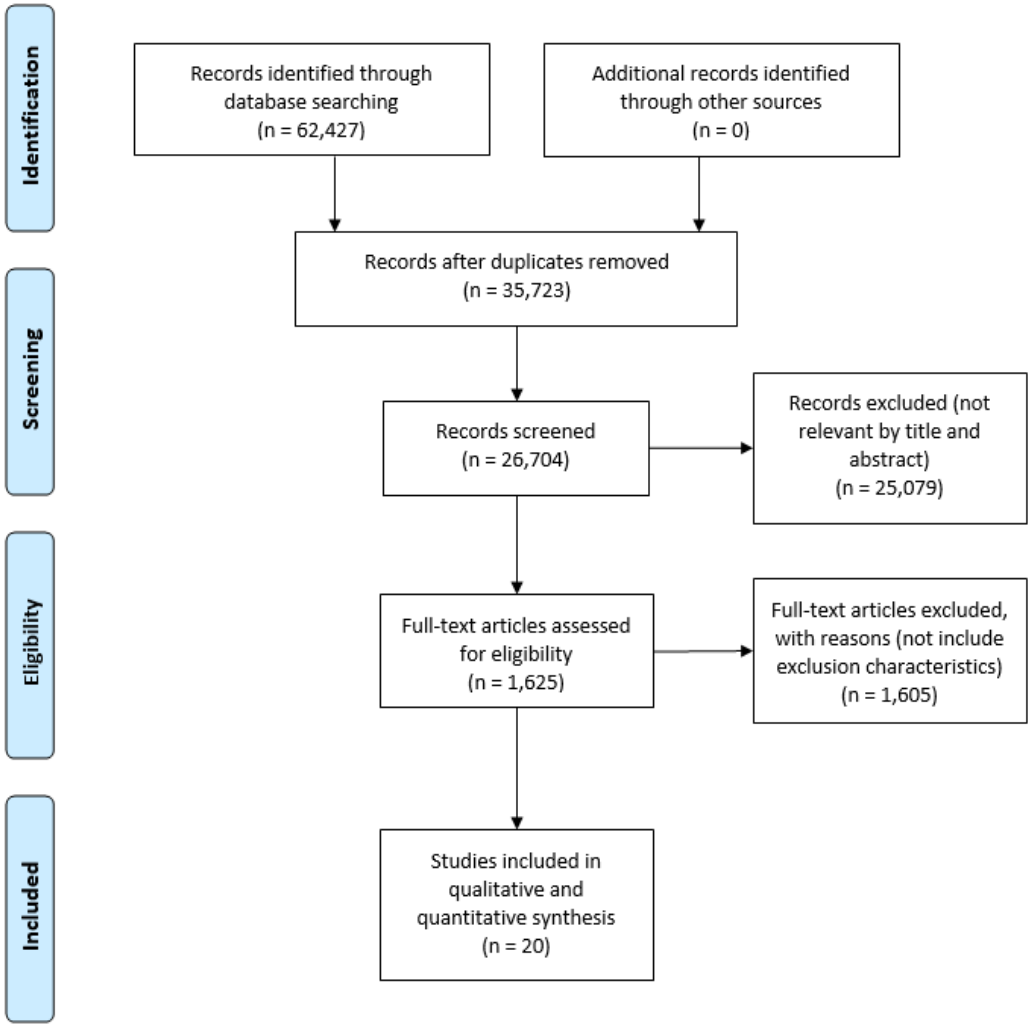

Figure 3.1 Flowchart of search strategy and selection.

Referring to PRISMA statement 2009, Figure 3.1 is an illustration of the procedures of search and study selection. A total 62,427 of articles were found from four different databases. By using Mendeley as references manager, 35,723 of duplicate articles and journals were removed. A total of 1,625 of full-text accessible articles and journals were assessed by excluding unrelated and irrelevant titles and abstract. Based on the exclusion criteria, a study related to only man, teenagers, and human cadaver, were excluded. After a thorough reading and analysis, 20 articles and journals were included. The articles chosen to be included were from the year 2001 to 2019. As for study design

of the included articles, 16 were cross-sectional studies, one was a case-control study, one was a cohort study and two were randomized controlled trial studies.

CHAPTER 4

RESULTS AND DISCUSSION

4.1 Descriptive of Selected Study

The summary of each article is presented in Table 4.1. Among the 20 articles selected, 16 were cross-sectional studies, one was a case-control study, one was a cohort study and two were randomized controlled trial studies. The articles selected were from the year 2001 till 2019. Only 5 out of 20 studies were conducted in Asia namely Japan (4 studies) and Korea (1 study). The age of participants selected for the studies ranged from a minimum of 18 years old to a maximum of 90 years old. Besides that, for the facial crease scoring, a total of two articles used Daniell's wrinkling score, two articles used Fitzpatrick and modified Fitzpatrick scale score, one article used Glogau scale score, while other articles either used Lemperle's scale score or the Wrinkle Severity Rating Scale.

Most of the articles investigated similar parameters namely BMI, sun exposure, smoking status, duration of menopause, hormonal changes, sociodemographic characteristics, alcohol consumption and skin colour. These parameters are either extrinsic or intrinsic factors in the formation of facial creases.

In general, a total of 15 studies found a negative correlation with skin ageing but only 11 has a negative correlation between BMI and facial crease. Meanwhile, six studies found no correlation between any parameters that may contribute to the formation of facial creases.