# AGEING OF MATURE SKIN AND THE RELEVANCE OF THE APPLICATION OF SUCCINIC, LACTIC AND MANDELIC ACIDS IN COSMETOLOGY

Eglė Ganda Bogdanienė[1*], Ramunė Skurkienė[1]
[1]St. Ignatius of Loyola College, Kaunas, Lithuania
[*]Corresponding author: egle.bogdaniene@stud.ilk.lt

## ABSTRACT

Skin ageing is a complex biological process determined by internal factors (genetic and hormonal) as well as external influences such as ultraviolet radiation, environmental pollution, and lifestyle. As society ages rapidly, demand for safe and effective cosmetic treatments that reduce age-related skin changes is increasing. These changes include loss of moisture, decreased elasticity, wrinkle formation, and alterations in pigmentation.

This study aimed to determine the effects of succinic, mandelic, and lactic acids, and their combinations, on mature facial skin. A qualitative research strategy was applied in the study. Empirical data were collected using skin diagnostics, photo-visualisation, and systematic observation. The participants of the study were five Lithuanian female artists aged 65-80 who actively participate in cultural and artistic life.

The study demonstrated that after a course of 5 procedures using succinic, mandelic, and lactic acids, significant improvements in facial skin hydration and elasticity were observed. Transepidermal water loss decreased, while skin texture and overall complexion tone improved. Minor changes in pigmentation and fine wrinkle indicators were also recorded. In addition to improvements in physical skin parameters, positive changes in emotional well-being were observed, including increased self-confidence and greater motivation to engage in creative activities.

The results suggest that combinations of succinic, mandelic, and lactic acids may serve as an effective and safe approach for the care of mature facial skin, improving both physiological skin parameters and overall well-being.

**Keywords:** *mature skin; succinic acid; lactic acid; mandelic acid; skin hydration; elasticity; wrinkles; pigmentation.*

## 1. INTRODUCTION

Skin ageing is a complex biological process characterised by structural and functional changes, including wrinkle formation, skin dryness, decreased elasticity, and alterations in pigmentation [1]. These changes lead not only to aesthetic but also to functional alterations of the skin, associated with a weakened epidermal barrier function and slower tissue regeneration [2]. Although skin ageing is a natural process, maintaining a youthful appearance is associated with better psychological well-being and social welfare [3].

The scientific literature emphasises that both intrinsic and extrinsic factors influence skin ageing. Intrinsic factors include genetic and hormonal changes, while extrinsic factors include ultraviolet radiation, air pollution, and lifestyle-related influences [4]. The interaction of these factors promotes the degradation of collagen and elastin, increases oxidative stress, and slows cellular renewal. In recent years, cosmetology has increasingly focused on bioactive substances that can slow skin ageing. Among these, lactic, mandelic, and succinic acids stand out for their milder effects compared to some other exfoliants, making them suitable for mature skin care. Studies indicate that lactic and mandelic acids promote epidermal exfoliation and skin renewal, while succinic acid possesses antioxidant and anti-inflammatory properties [5,6]. However,

scientific research examining the combined effects of these acids on mature skin remains limited. In Lithuania, data on the effects of combinations of lactic, mandelic, and succinic acids on skin hydration, elasticity, wrinkle depth, and pigmentation are very scarce. Therefore, the results of this study may contribute new insights into the application of these substances in cosmetology and in mature skin care protocols.

Skin ageing is a complex biological process influenced by both genetic and environmental factors. In recent decades, the ageing of society has become increasingly evident, leading to a growing demand for effective, safe skin care measures to reduce age-related skin changes [7]. Promising active substances in this field include lactic, mandelic, and succinic acids, which, due to their biological properties, may have beneficial effects on mature skin. However, scientific data on the combined effects of these acids on physiological skin parameters remain limited. Therefore, the following research question is formulated: What is the effect of succinic, mandelic, and lactic acids, as well as their combinations, on mature facial skin?

The empirical study employs a qualitative research strategy. Data analysis is carried out using methods of scientific literature analysis and systematisation. Empirical data are collected using a skin diagnostic device, a photo-visualisation method, and systematic observation.

## 2. LITERATURE REVIEW

The skin is the largest organ of the human body and performs essential protective, metabolic, and sensory functions [8]. It acts as a physical barrier protecting the body from ultraviolet radiation, pathogens, toxic substances, and mechanical damage. In addition, the skin participates in thermoregulation, immune response, sensory perception, and vitamin D synthesis (see Fig. 1).

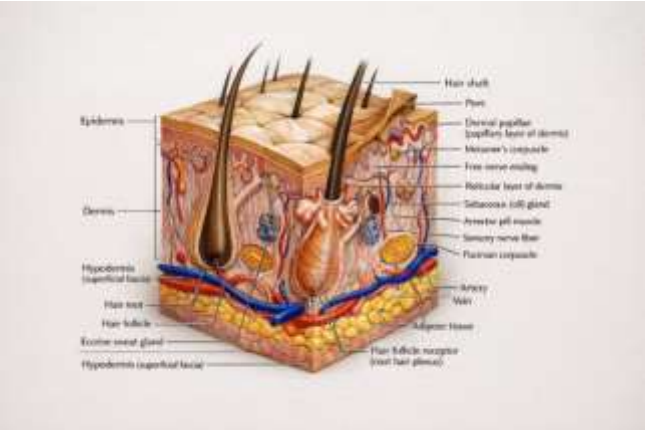


**Figure 1** Skin Structure

Structurally, the skin consists of three main layers: the epidermis, dermis, and subcutaneous tissue [9]. The epidermis is the outermost layer, forming a protective barrier against external factors. Continuous cell regeneration takes place in this layer, and keratinocytes constitute the main cell population of the epidermis. Melanocytes located in the epidermis produce melanin, a pigment that protects the skin from ultraviolet radiation [10].

The dermis, located beneath the epidermis, is composed of connective tissue rich in collagen and elastin fibres. These structures provide the skin with strength and elasticity. The dermis also contains blood vessels, nerve endings, sweat glands, and

sebaceous glands [11]. The subcutaneous tissue, also known as the hypodermis, consists of adipose and connective tissues and performs protective and thermoregulatory functions [12].

### 2.1. Factors of Skin Ageing

Skin ageing is a complex process influenced by chronological ageing, hormonal changes, and environmental factors [13]. With ageing, fibroblast activity and collagen synthesis decrease in the skin, leading to a thinner, less elastic skin that is more prone to wrinkle formation [14].

Skin ageing is generally classified into intrinsic and extrinsic ageing. Intrinsic ageing is a natural physiological process related to genetic and metabolic changes. It is characterised by thinning of the epidermis, dryness, fine wrinkles, and a gradual decrease in skin elasticity [4]. Extrinsic ageing results from environmental influences. The main external ageing factors include ultraviolet radiation, air pollution, smoking, poor nutrition, and chronic stress [15]. These factors promote oxidative stress, collagen degradation, and changes in pigmentation.

### 2.2. Photoageing and Environmental Impact

Photoageing is considered one of the most important causes of extrinsic skin ageing (see Fig. 2). Long-term exposure to ultraviolet radiation stimulates the formation of reactive oxygen species, which can damage cellular structures and promote collagen degradation [6].

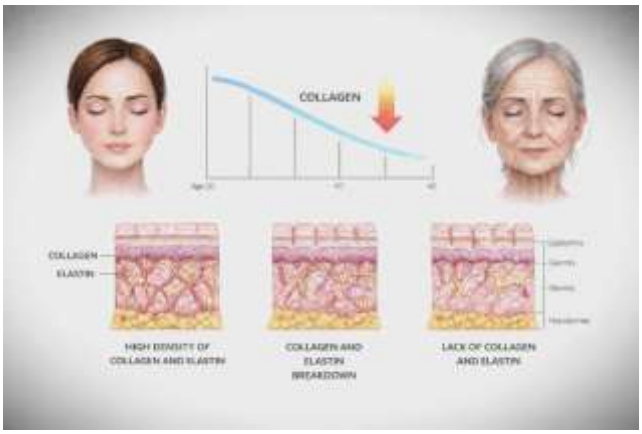


**Figure 2** Skin Ageing Process (generated by ChatGPT based on the author's text).

In addition to ultraviolet radiation, air pollution also significantly impacts skin ageing. Continuous exposure to environmental pollutants, such as ozone, particulate matter, and polycyclic aromatic hydrocarbons, can accelerate skin ageing and impair the skin's barrier function [16]. Moreover, studies indicate that air pollution may contribute to the formation of wrinkles and pigmentation disorders [17]. Climatic conditions also influence the condition of the skin. Dry air and low temperatures can reduce skin hydration and intensify skin irritation [18].

In summary, the skin is a complex biological organ that performs important protective and physiological functions. Skin ageing is a multifactorial process influenced by both intrinsic biological and external environmental factors. The most common signs of ageing include reduced elasticity, wrinkle formation, pigmentation changes, and skin dryness. These changes encourage the search for effective cosmetic solutions that can improve the condition of mature skin and slow the ageing process.

## 2.3. Classification of Facial Skin Ageing Types

Mature skin is generally characterised by structural and functional changes that distinguish it from younger skin. With ageing, the skin becomes thinner, more fragile, and less elastic. In clinical practice, mature skin is often described as blotchy, yellowish, rough, and sagging. One characteristic change is the thickening of the superficial epidermal layer, due to impaired shedding of cells from the stratum corneum. As a result, corneocytes accumulate on the skin surface, leading to uneven skin texture and reduced radiance.

Fibroblasts play an important role in maintaining the structure of the skin. These cells are responsible for synthesising collagen, elastin, and hyaluronic acid, which help maintain skin firmness, elasticity, and moisture retention. With age, fibroblast activity decreases, resulting in reduced levels of collagen, functional elastin, and hyaluronic acid in the skin. These changes lead to skin thinning, loss of elasticity, and wrinkle formation [19].

Knowledge of skin type and its characteristics is an important factor when selecting appropriate skin care products and planning aesthetic or medical procedures. Improperly chosen cosmetic products may cause skin irritation, disruption of the barrier function, or undesirable reactions. Therefore, before performing cosmetological or dermatological procedures, it is essential to evaluate the individual characteristics of the skin in order to select the most appropriate treatment or care strategy [20].

The classification of skin types is complex, as skin characteristics may change over time due to biological, environmental, or lifestyle factors. In addition, globalisation and the interaction among diverse ethnic groups increasingly expose practitioners to a range of skin phenotypes with specific care requirements. Therefore, accurate assessment of skin type and condition is essential to ensure the effective and safe application of cosmetic and medical procedures. Incorrect determination of skin type may lead to inappropriate decisions that can cause physiological changes in the skin or undesirable reactions [21].

In clinical practice, facial skin ageing is evaluated using various methods, including clinical assessments, standardised scales, imaging analysis systems, and histological studies. Most often, the initial assessment is carried out during a clinical examination using specially developed classification scales that allow a more objective evaluation of skin ageing signs.

One of the most widely used classification systems is the Glogau Photoaging Scale. This scale is used to assess the degree of photoageing and the severity of wrinkles, while accounting for structural changes in the skin. According to this classification, four types of photoageing are distinguished. The first type is characterised by early photoageing, with minimal wrinkles and minimal pigmentation changes. The second type includes wrinkles during facial expression, early pigment spots, and mild keratosis. Visible wrinkles at rest, clear pigmentation changes, and visible capillaries characterise the third type. The fourth type describes severe photoageing, characterised by deep wrinkles, a yellowish-grey skin tone, and possible precancerous skin changes (see Fig. 3).

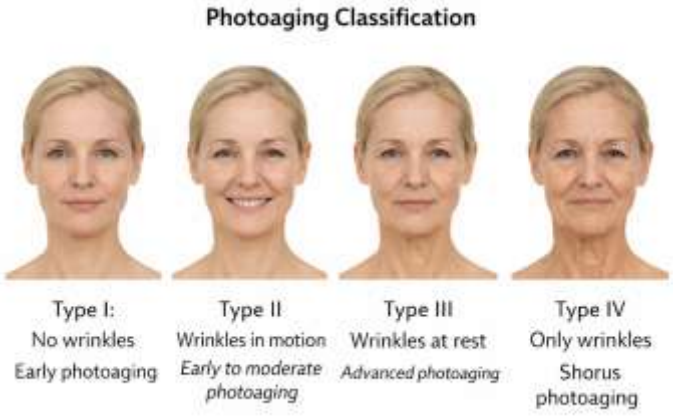


**Figure 3** Glogau Photoaging Classification (generated by ChatGPT based on the author's text).

Photoageing is one of the most significant factors of extrinsic skin ageing. It results from long-term exposure to ultraviolet radiation, which promotes collagen degradation, oxidative stress, and structural changes in the dermis. As a result of these processes, wrinkles develop, pigmentation disorders appear, and skin elasticity decreases. To more accurately assess the extent of skin damage and select the most appropriate treatment strategies, various classification systems are used in clinical practice [22].

However, the Glogau scale has certain limitations, as the assessment may be subjective and dependent on the clinical evaluator's experience. Furthermore, this scale does not always accurately reflect photoaging signs in individuals with different racial or ethnic skin types. Recent studies aim to reduce this subjectivity by combining clinical evaluation scales with digital skin analysis systems. For example, in a study by Oesch et al. (2022), the Glogau scale was integrated with the VISIA® digital skin analysis system, which allows a more objective assessment of photodamage. Such methods help determine the influence of lifestyle factors, such as smoking, alcohol consumption, and stress, on skin ageing.

Another widely used assessment system is the Fitzpatrick Wrinkle and Elastosis Scale. This scale allows the evaluation of the depth of facial wrinkles and the degree of elastosis resulting from the degradation of elastic fibres in the dermis. According to this classification, the severity of wrinkles is divided into several categories, ranging from fine superficial wrinkles to deep structural skin changes. First-degree changes include fine wrinkles and minimal texture changes. The second degree is characterised by moderately deep wrinkles and more pronounced irregularities of the skin surface, while the third degree describes deep wrinkles and marked elastosis [23].

To more precisely evaluate wrinkle depth and progression, a modified Fitzpatrick wrinkle scale was developed. This scale provides a more detailed assessment by including additional intermediate severity categories. According to this system, several wrinkle levels are distinguished, ranging from the complete absence of wrinkles to deep furrows exceeding 3 mm in depth. Such a classification allows a more accurate quantitative evaluation of skin ageing signs and enables the monitoring of the effectiveness of cosmetic or dermatological procedures [24].

Studies indicate that the modified Fitzpatrick scale demonstrates high inter-rater reliability and can be effectively used to assess wrinkles in various facial areas, including nasolabial folds and changes in the lip region (see Fig. 4).


**Figure 4** Modified Fitzpatrick Wrinkle Scale (generated by ChatGPT based on the author's text).

In summary, evaluating facial skin ageing is a complex process that involves clinical examination, standardised assessment scales, and modern digital analysis technologies. Classification systems such as the Glogau and Fitzpatrick scales enable a more objective assessment of the degree of skin ageing and help in selecting the most appropriate therapeutic or cosmetological interventions. The application of these methods in clinical practice creates the conditions for a more accurate evaluation of skin condition and for monitoring the effectiveness of applied procedures.

### 2.4. Application of Acid Combinations in Mature Skin Care

In addition, during cosmetology courses at "Oda Akademija," studying acid combination methodologies, theory and practice-based training indicated that combining different acids in mature skin care procedures may yield positive results. Data from the scientific literature also suggest that properly selected chemical peels can improve skin texture and moisture balance and reduce signs of photoageing.

### 2.5. Characteristics of the Acids Used

**Succinic acid** is a naturally occurring dicarboxylic acid with the chemical formula $C_4H_6O_4$. It is an important component of cellular metabolism and participates in the Krebs cycle, one of the main energy-generating pathways in the mitochondria of eukaryotic cells [25]. This acid is naturally found in plants, animal tissues, and minerals such as amber.

In cosmetology, succinic acid is valued for its antioxidant, anti-inflammatory, and regenerative properties. It may improve microcirculation, stimulate cellular metabolism, and enhance skin tone [26]. Studies indicate that succinic acid may modulate the expression of ageing markers, suggesting that it may influence cellular ageing processes [27]. Succinic acid also exhibits antioxidant activity, helping to neutralise free radicals—one of the main factors contributing to skin ageing [28]. Furthermore, it has a mild exfoliating effect that helps remove dead epidermal cells and improve skin texture [29].

According to the Globally Harmonised System of Classification and Labelling of Chemicals (GHS), succinic acid is not classified as toxic or highly irritating and is therefore considered a safe active ingredient for use in cosmetic products. However, higher concentrations may cause temporary skin irritation, redness, or a burning sensation, particularly in individuals with sensitive skin [30].

**Lactic acid** is an alpha-hydroxy acid (AHA) with the chemical formula $C_3H_6O_3$. It is naturally produced during fermentation and during anaerobic glycolysis in the human body [31]. In dermatology and cosmetology, lactic acid is widely used as a chemical exfoliant that helps remove dead epidermal cells and stimulate skin regeneration. In addition, this acid has humectant properties—it attracts and retains moisture in the epidermis, thereby helping to strengthen the skin barrier function [32].

Clinical studies show that long-term use of alpha hydroxy acids can promote epidermal thickening, improve dermal structure, and reduce signs of photoageing such as hyperpigmentation, uneven skin texture, and fine wrinkles. Due to these properties, lactic acid peels are often used in mature skin care procedures.

**Mandelic acid** is an aromatic alpha-hydroxy acid with the chemical formula $C_8H_8O_3$. It is derived from bitter almonds or synthesised in a laboratory. Due to its larger molecular structure, this acid penetrates the skin more slowly than other AHA acids, leading to less irritation [33]. Mandelic acid has keratolytic, antibacterial, and depigmenting properties. It stimulates epidermal regeneration, improves skin texture, and reduces hyperpigmentation. Because of its milder action, this acid is often used to treat sensitive or photoaged skin [34].

**Phytic acid** (inositol hexaphosphate) is a naturally occurring plant-derived compound found in grains and seeds. In dermatology, it is used as a mild chemical peel component with antioxidant and depigmenting properties. Phytic acid can inhibit the activity of the enzyme tyrosinase, which is involved in melanin synthesis, thereby helping reduce hyperpigmentation and improve uniformity of skin tone [35]. In addition, this acid exhibits a chelating effect and helps neutralise free radicals.

### 2.6. Principles of Chemical Peels

Chemical peels are procedures in which acidic solutions are applied to the skin, causing controlled exfoliation of the epidermis. During this process, dead skin cells are removed, while the proliferation of new cells and collagen synthesis is stimulated.

Based on their depth of effect, chemical peels are divided into three main categories: superficial, medium-depth, and deep. Superficial peels affect the epidermis and are most commonly used to improve skin texture and reduce pigmentation. Medium-depth peels may reach the upper dermis and are used to correct more pronounced skin changes. Deep peels target deeper dermal layers and are used to treat significant skin damage.

The effect of a chemical peel depends on several factors, including the acid concentration, pH, exposure time, and skin condition. Therefore, the procedure protocol must be selected individually, taking into account the patient’s skin type and condition.

## 3. RESULTS AND DISCUSSION

In consultation with specialists from Skin Academy, several acid-combination protocols for mature skin care were developed. A practical study was conducted with one patient (JS), who underwent a course of five procedures over seven weeks (2026-01-12 – 2026-02-27).

Before the procedures began, a medical history was collected to assess possible contraindications, including cardiovascular disease, hypertension, diabetes, allergies, and medications being used. The skin's condition was also evaluated, including hydration level, elasticity, wrinkle depth, pigmentation, and skin texture. During the procedures, combinations of three acids, succinic, lactic, and mandelic acid peels

were applied, supplemented with phytic acid and other regeneration-promoting components.

After determining the client's skin type (dry, combination) and condition (moisture level, tone, circulation, wrinkles, sensitivity, pores, comedones, milia, acne, skin thickness, color, and flaking), and after listening to the client's expectations, five procedures combining three acids were performed: two procedures for mature skin, two procedures for mature, dull, and elasticity-loss-affected skin, and one procedure aimed at optimal skin renewal.

**Protocol 1**

**Procedure for mature skin. Performed twice for the client**

**Products used:**

Active cleanser with succinic acid (Pre-Peel 2-4 ml);

Succinic acid peel (2-4 ml, 1-2 min);

Neutralising agent.

After completing the first stage of the procedure, the main skin peeling is performed with 2.5% succinic acid and a prolonged-action mask base, followed by a 3% retinol peel and a brightening and whitening concentrate. The mixture, prepared in equal proportions in a container, is poured into the prepared amber mask. The mask is left until it hardens. It is then rinsed off with water, and the skin is gently dried. If the skin is sensitive, it is recommended to neutralise the skin with a neutralising agent after the peel.

After neutralising the acid peel, a hyaluronic acid serum is applied. This is followed by the application of a stimulating alginate mask with spirulina and menthol. Once the mask hardens on the skin surface, it is gently removed with warm water.

After removing the mask, the face is covered with a nourishing cream containing hemp oil. Subsequently, the face is protected with a facial sunscreen with SPF 30.

One of the main components of the procedure is succinic acid. According to Theunissen and Courbes (2018), this substance is not yet widely used in cosmetic and personal care products, although its biological properties have already been discussed in the scientific literature. Research indicates that succinic acid may modulate the expression of ageing and pluripotency markers, suggesting that it may influence cellular ageing processes.

Levy (2022) notes that succinic acid possesses antioxidant properties that help neutralise free radicals and reduce oxidative stress, one of the most important factors contributing to skin ageing. As a result, fine lines and wrinkles may decrease, and the skin may appear more youthful. In addition, this acid has anti-inflammatory properties and may help soothe irritated, sensitive skin.

Saxena et al. (2017) state that in cosmetics, succinic acid is also valued for its mild exfoliating effect. It helps remove dead skin cells, improves skin texture and tone, and enhances skin radiance. This is particularly relevant for mature skin, which is often characterised by dullness and uneven pigmentation.

According to the Globally Harmonised System of Classification and Labelling of Chemicals (Globally Harmonised System, 2017), succinic acid is not classified as toxic, corrosive, or strongly irritating to the skin. Therefore, cosmetic products are considered relatively safe and generally well-tolerated across various skin types.

Nevertheless, side effects are possible. The most common reactions include skin irritation, such as redness, itching or a burning sensation, especially in individuals with sensitive skin or when higher concentrations are used. Contact with the eyes

should be avoided, and succinic acid should be combined cautiously with other acids, as this may increase the risk of irritation (Hartwig et al., 2018; Saxena et al., 2017).

**Protocol 2**

**Procedure for mature, dull, and elasticity-loss-affected skin. Performed twice for the client**

**Products used:**

Active cleanser with 15% lactic acid (Pre-Peel 2-4 ml). During the procedure, an ultrasonic spatula is recommended.

40% mandelic acid peel (2-4 ml, 1-2 min). Recommended exposure time: 1-2 minutes;

Neutralising agent.

After completing the first stage of the procedure, the main skin peel is performed using a 40% mandelic acid peel and a 40% phytic acid peel (2-4 ml, up to 10 minutes). After the peel, it is recommended to neutralise the skin with a neutralising agent.

After neutralising the acid peel, a hyaluronic acid serum is applied. Next, a restorative serum with vitamin C and reHeal is applied, followed by a stimulating alginate mask with spirulina and menthol. Once the mask hardens on the skin's surface, it is gently removed with warm water.

After removing the mask, the face is protected with a facial sunscreen with SPF 30.

**Protocol 3**

**Procedure for optimal skin renewal. Performed once for the client**

**Products used:**

Active cleanser with 15% lactic acid (Pre-Peel 2-4 ml). During the procedure, an ultrasonic spatula is recommended.

40% lactic acid peel (2-4 ml, 1-2 min). Recommended exposure time: 1-2 minutes;

Neutralising agent.

After completing the first stage of the procedure, the main skin peel is performed using a 40% mandelic acid peel and a 40% phytic acid peel (2-4 ml, up to 10 minutes). After the peel, it is recommended to neutralise the skin with a neutralising agent.

After neutralising the acid peel, a hyaluronic acid serum is applied. Next, a restorative vitamin C serum is applied, followed by a stimulating alginate mask with spirulina and menthol. Once the mask has hardened on the skin's surface, it is gently removed with warm water.

After the mask is removed, the face is treated with a 3% retinol peel, which is washed off after 2-4 hours. After rinsing off the 3% retinol peel, the face is protected with a facial sunscreen with SPF 30.

An important component of the procedures analysed in this study is the use of lactic, mandelic, and phytic acids in cosmetology, owing to their ability to stimulate skin renewal, improve skin structure, and reduce signs of ageing.

**Lactic acid** stimulates glycosaminoglycan synthesis and may improve dermal collagen structure, thereby increasing skin elasticity and reducing the visibility of fine wrinkles (Barel, Paye & Maibach, 2014). Clinical studies indicate that the use of alpha-hydroxy acids (AHAs), including lactic acid, can improve the condition of mature skin by promoting epidermal thickening, enhancing dermal structure, and reducing signs of photoageing, such as hyperpigmentation, uneven skin surface, and fine wrinkles (Ditre et al., 1996). In addition, lactic acid has moisturising properties, acting as a humectant and helping maintain optimal epidermal hydration (Baumann, 2009). Due to these properties, lactic acid peels can improve skin texture and tone,

promote regeneration, and reduce uneven pigmentation. Although this procedure is considered safe, temporary redness, a burning sensation, or mild flaking may occur after treatment (Draelos, 2016).

**Mandelic acid** is an aromatic AHA acid which, due to its larger molecular structure, penetrates the skin more slowly than other acids of this group. As a result, it causes less irritation and is suitable for sensitive and mature skin (Barel, Paye & Maibach, 2014). Chemical peeling induces controlled epidermal exfoliation, stimulates keratinocyte proliferation, and may promote collagen synthesis (Draelos, 2016). Mandelic acid peels have keratolytic, antibacterial, and depigmenting effects, thereby improving skin texture and reducing hyperpigmentation and fine wrinkles. Due to its milder action, it is often used to treat signs of photoageing, melasma, or post-inflammatory hyperpigmentation (Rendon & Gaviria, 2005). Possible side effects usually include temporary redness, a burning sensation, or mild flaking.

**Phytic acid** is a natural plant-derived compound found in grains, legumes, and seeds. In dermatology, it is used as a mild component of chemical peels due to its antioxidant and depigmenting properties (Baumann, 2009). Phytic acid inhibits the activity of tyrosinase, an enzyme involved in melanin synthesis, thereby helping reduce pigmentation spots and improve skin tone uniformity (Serup, Jemec & Grove, 2017). In addition, this acid neutralises free radicals and reduces oxidative stress, which may help reduce the signs of photoageing. After such procedures, a more even skin tone, reduced pigmentation, improved skin texture, and a brighter complexion are usually observed. Possible side effects are generally limited to temporary redness or mild flaking.

Acid masks and serums are gentle skincare products that moisturise, brighten, smooth the skin, and reduce fine wrinkles. They can be used both at home and in beauty salons. Acid masks are typically applied to clean skin and left on for a specified period before rinsing off. Serums have a lighter consistency and are applied after cleansing, before a moisturiser or a facial sunscreen with SPF.

Evaluation of the Research Results

The condition of the skin was assessed using the A-ONE Smart diagnostic system, which enables objective measurement of skin hydration, elasticity, wrinkles, and pigmentation.

**Figure 5**. Recording of the Client's Skin Condition Before the Procedures

The hydration index indicates the amount of water in the epidermis and allows evaluation of the condition of the skin barrier. The elasticity parameter describes the skin's ability to stretch and return to its original shape, which is directly related to the collagen and elastin structure in the dermis. The wrinkle index assesses the depth and

distribution of wrinkles, while the pigmentation indicator describes the uniformity of melanin distribution.

**Figure 6** Recording of the Client's Skin Condition After 5 Procedures

Over seven weeks, after five procedures, positive changes in skin condition were observed. The skin elasticity index increased from 7% to 78%, the pigmentation index decreased from 46% to 42%, and the wrinkle index decreased from 60% to 56%. These data indicate that the systematic application of acid combinations may improve the condition of mature skin.


**Figure 7** Recording of the Client's Skin Condition After the Procedures

Over a period of seven weeks, after performing five procedures and summarising the results of three skin assessment indicators obtained using the A-ONE Smart diagnostic system, it can be observed that the systematic and responsible use of a combination of three acids produced positive results. These acids softened and moisturised the patient's facial skin and worked effectively in combination with other ingredients, such as hyaluronic acid, which enhances their effect (see Fig. 8).

The gentle exfoliating action removes dead skin cells, giving the skin a smoother and more radiant appearance. Another advantage of combining acids for the skin is their ability to brighten the complexion, enhance radiance, and even out skin tone. This combination helps inhibit the production of melanin, the pigment responsible for dark spots and hyperpigmentation, fade existing discolouration, and prevent the formation of new spots. As a result, the facial complexion becomes more even (Saxena et al., 2017).

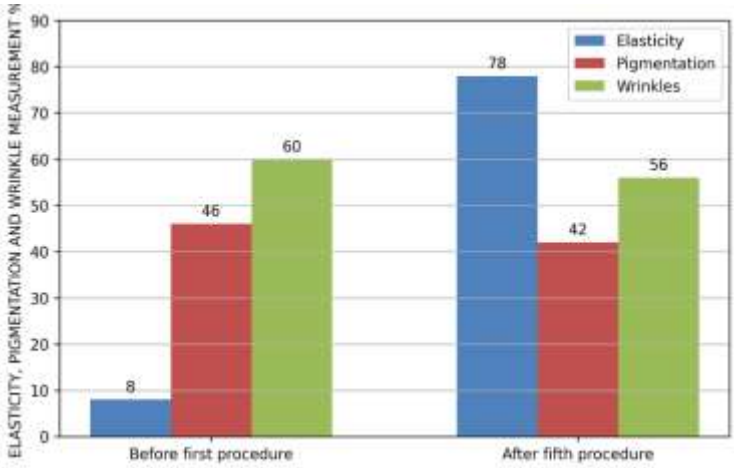


**Figure 8** Results of the Client's Skin Elasticity, Pigmentation, and Wrinkle Assessment

The research results were evaluated based on the diagnostic device's scale unit values.
Skin Hydration Parameters
**Low level (0-33%)**: The skin is dry, rough, and flaky, with a feeling of tightness. The skin barrier is impaired.
**Medium level (34-66%)**: Normal hydration; the skin barrier function is maintained.
**High level (67-100%)**: The skin is well hydrated, the epidermal barrier function is strong, transepidermal water loss is low, and the skin is resistant to irritants.
**Skin Elasticity Parameters**
**Low level (0-33%)**: Reduced elasticity, deficiency of collagen and elastin, sagging and tired skin, typical of mature skin.
**Medium level (34-66%)**: Normal skin structure and tone.
**High level (67-100%)**: Very good skin tone and firmness; the skin quickly regains its shape after pressure.
**Wrinkle Parameters**
**Low level (0-33%)**: Almost no wrinkles; smooth skin texture.
**Medium level (34-66%)**: Fine to moderate wrinkles; reduced firmness.
**High level (67-100%)**: Deep and pronounced wrinkles caused by ageing, UV exposure, or dehydration.
**Pigmentation Parameters**
**Low level (0–-33%)**: Even skin tone with minimal pigmentation.
**Medium level (34-66%)**: Physiological pigmentation with minor irregularities, isolated pigment changes.
**High level (67-100%)**: Pronounced pigment spots and hyperpigmentation.
**Research Ethics**
During the research, the fundamental principles of scientific research ethics were followed. The participant was informed about the purpose of the study, the course of the procedures, and the intended use of the results in scientific work. The study aimed to ensure the participants' safety, confidentiality, and voluntary participation.
As noted by Gaižauskaitė and Valavičienė (2016), the researcher should maintain neutrality throughout the study, avoid evaluative judgments, and ensure respectful and ethical communication with research participants.

## 4. CONCLUSIONS

1. Succinic, lactic, and mandelic acids possess properties that may improve the condition of mature skin.
2. Combining acids in procedures provides a broader spectrum of action, more targeted problem-solving, and a more individualised effect on the skin.
3. After the course of procedures, a significant improvement in skin hydration and elasticity was observed.
4. Changes in wrinkles and pigmentation were smaller; however, a general improvement in skin tone and texture was observed.
5. Acid combinations may be an effective approach for mature skin care in cosmetological practice.

## REFERENCES

1. Liang, Y., Su, W., & Wang, F. (2023). Skin ageing: A progressive, multi-factorial condition demanding an integrated, multilayer-targeted remedy. *Clinical, Cosmetic and Investigational Dermatology*, 16, 1215–1229.
2. Russell-Goldman, E., & Murphy, G. F. (2020). The pathobiology of skin aging: New insights into an old dilemma. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7481755/
3. Zhang, S., & Duan, E. (2018). Fighting against skin aging: The way from bench to bedside. Available at: https://pubmed.ncbi.nlm.nih.gov/29692196/
4. Trojahn, C., Dobos, G., Lichterfeld, A., Blume-Peytavi, U., & Kottner, J. (2015). Characterizing facial skin ageing in humans: Disentangling extrinsic from intrinsic biological phenomena. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4341846/
5. Shoshani, D., Markovitz, E., Monstrey, S. J., & Narins, D. J. (2008). The modified Fitzpatrick wrinkle scale: A clinically validated measurement tool for nasolabial wrinkle severity assessment. *Dermatologic Surgery*, Suppl. 1, S85-S91.
6. Wong, Q. Y. A., & Chew, F. T. (2021). Defining skin aging and its risk factors: A systematic review and meta-analysis. *Scientific Reports*, 11, 22075.
7. Ayer, J., & Griffiths, C. E. M. (2019). Photoaging in Caucasians. In *Cutaneous Photoaging* (pp. 1-30). London: Royal Society of Chemistry.
8. Bard, S. (2021). *Skin: How it works.* Available at: https://www.medicalnewstoday.com/articles/320435
9. Barel, A. O., Paye, M., & Maibach, H. I. (2014). *Handbook of Cosmetic Science and Technology* (4th ed.). Boca Raton: CRC Press.
10. Baumann, L. (2009). *Cosmetic Dermatology: Principles and Practice.* New York: McGraw-Hill.
11. Chaudhary, M., Khan, A., & Gupta, M. (2020). Skin ageing: Pathophysiology and current market treatment approaches. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7403684/
12. Draelos, Z. D. (2016). *Cosmetic Dermatology: Products and Procedures.* Wiley-Blackwell.
13. Fuks, K. B., Hüls, A., Sugiri, D., Altug, H., Vierkötter, A., Abramson, M. J., et al. (2019). Tropospheric ozone and skin aging: Results from two German cohort studies. Available at: https://pubmed.ncbi.nlm.nih.gov/30641257/

14. Gaižauskaitė, I., & Valavičienė, N. (2016). *Social Research Methods: Qualitative Interview.* Mykolas Romeris University.
15. Graham, H. K., Eckersley, A., Ozols, M., Mellody, K. T., & Sherratt, M. J. (2019). Human skin: Composition, structure and visualisation methods. In G. Limbert (Ed.), *Skin Biophysics* (Studies in Mechanobiology, Tissue Engineering and Biomaterials, Vol. 22). Springer.
16. Gupta, V., & Sharma, V. K. (2019). Skin typing: Fitzpatrick grading and others. *Clinics in Dermatology*, 37(5), 430-436.
17. Hartwig, A. (2018). Succinic acid [MAK Value Documentation, 2017]. In *The MAK Collection for Occupational Health and Safety* (pp. 592-605). Wiley.
18. Haydont, V., Bernard, B. A., & Fortunel, N. O. (2019). Age-related evolutions of the dermis: Clinical signs, fibroblast and extracellular matrix dynamics. *Mechanisms of Ageing and Development*, 177, 150–156.
19. Haydont, V., & Fortunel, N. O. (2019). Aging of skin stem cells and their niches. *Ageing Research Reviews*, 50, 109-121.
20. Krutmann, J., Bouloc, A., Sore, G., Bernard, B. A., & Passeron, T. (2017). The skin aging exposome. *Journal of Dermatological Science*, 85(3), 152-161.
21. Levy, J. (2022). *Succinic acid benefits for skin and how to use it.* Available at: https://draxe.com/beauty/succinic-acid-benefits/
22. Lopez-Ojeda, W., Pandey, A., Alhajj, M., et al. (2022). Anatomy, skin (integument). In *StatPearls*. Treasure Island (FL): StatPearls Publishing. Available at: https://www.ncbi.nlm.nih.gov/books/NBK441980/
23. Maranduca, M. A., Branisteanu, D., Serban, D. N., Branisteanu, D. C., Stoleriu, G., Manolache, N., & Serban, I. L. (2019). Synthesis and physiological implications of melanic pigments. *Oncology Letters*, 17(5), 4183-4187.
24. Nam, G. W., Baek, J. H., Koh, J. S., & Hwang, J. K. (2015). The seasonal variation in skin hydration, sebum, scaliness, brightness and elasticity in Korean females. *Skin Research and Technology*, 21(1), 1-8.
25. Nelson, D. L., & Cox, M. M. (2017). *Lehninger Principles of Biochemistry* (7th ed.). New York: W. H. Freeman.
26. O'Connor, A. A., Lowe, P. M., Shumack, S., & Lim, A. C. (2018). Chemical peels: A review of current practice. *Australasian Journal of Dermatology*, 59(3), 171-181.
27. Oliveira, R., Ferreira, J., Azevedo, L. F., & Almeida, I. F. (2023). An overview of methods to characterize skin type: Focus on visual rating scales and self-report instruments. *Cosmetics*, 10(1), 14.
28. Proietti, I., Skroza, N., & Potenza, C. (2021). Improving skin quality in patients with dermatologic conditions using the hyaluronic acid filler VYC12. *Italian Journal of Dermatology and Venereology*, 156(6), 720-721.
29. Puri, P., Nandar, S., Kathuria, S., & Ramesh, V. (2017). Effects of air pollution on the skin: A review. *Indian Journal of Dermatology, Venereology and Leprology*, 83, 415-423.
30. Rendon, M. I., & Gaviria, J. I. (2005). Review of chemical peels in melasma. *Journal of Cosmetic Dermatology*.
31. Sachs, D. L., Varani, J., Chubb, H., Fligiel, S. E. G., Cui, Y., Calderone, K., Helfrich, Y., Fisher, G. J., & Voorhees, J. J. (2019). Atrophic and hypertrophic photoaging: Clinical, histologic, and molecular features of two distinct phenotypes. *Journal of the American Academy of Dermatology*, 81, 480-488.

32. Saxena, R. K., Saran, S., Isar, J., & Kaushik, R. (2017). Production and applications of succinic acid. In *Current Developments in Biotechnology and Bioengineering.* Elsevier.
33. Serup, J., Jemec, G. B. E., & Grove, G. L. (2006). *Handbook of Non-Invasive Methods and the Skin.* CRC Press.
34. Shacknai, G. (2023). Succinic acid for skin: Everything you need to know according to dermatologists. Available at: https://www.cosmopolitan.com/style-beauty/beauty/a43775714/succinic-acid-for-skin/
35. Turkevych, A., Derkach, N., Kupriyanova, A., & Zubair, L. (2020). Improving skin quality with hyaluronic and succinic acid. Available at: https://www.researchgate.net/publication/340209183