

CHAPTER 1

INTRODUCTION

1.1. Project background

Aging is an inescapable process that occurs in every cell in the human body. While aging of the internal organ is not conspicuous by ambient eyes, the skin provides obvious signs over the passing time. Typical features of skin aging include saggy, thin, and dry skin, decreased elasticity, abnormal pigmentation, and wrinkles (Addor, 2018; Wang & Dreesen, 2018). According to Montemurro & Gillen (2013), changes related to skin aging draw people, especially women, further away from social attractiveness. In accordance, due to the importance of skin for self-image, people are willing to spend grand amounts of money to keep their youthful appearance. As a result, demands for solutions against skin aging have skyrocketed. IMARC (2021) mentioned that the global anti-aging market value has reached US\$ 58.5 billion in 2021 and is predicted to reach US\$ 88.3 billion in 2026.

In the past few years, the field of esthetic and cosmeceutical dermatology has gained more attention. Several strategies have been developed to delay skin aging; procedures such as chemical peels lead to skin tightening as a result of damaged skin tissue regeneration and repair. Rejuvenation, resurfacing, and tightening of the skin can also be achieved by using intense pulsed light or radiofrequency technology. In addition, the use of dermal fillers and botulinum toxin results in wrinkle reduction. However, these methods are known to be invasive (Ganceviciene et al., 2012; Wollina et al., 2008), not to mention cost-ineffective, and can only be performed by a dermatologist. Consequently, people nowadays are leaning more towards topical skincare, which is simpler, less invasive, less expensive, yet proven to be effective against skin aging (Ganceviciene et al., 2012; Rodan et al., 2016).

Topical skincare products are divided into different types, including serums, moisturizers, creams, lotions, essence, toners, sunscreens, antiseptic ointments, and many more. Serum is one of the consumers' favored products due to its high concentration of active ingredients in its formulation, thus providing thorough nutritional benefits for deeper skin layers. In addition, serums are usually designed to have non-greasy finish products which are comfortable to use (Budiasih et al., 2018). Serum-0921-E, and from now will be referred to as Serum E¹, is an ultimate, leave-on super serum with liquid-emulsion properties. Serum E contains various active ingredients with multiple benefits: it enhances skin rejuvenation, removes wrinkles, fine lines, uneven skin tone, big pores, and rough texture, maintains skin moisture, firmness, and elasticity, skin brightening, and antioxidant activity.

Regardless of the claimed benefits, according to *Peraturan Menteri Kesehatan RI* no.1175/MENKES/Per/VIII/2010, cosmoceuticals need to undergo safety and efficacy screening before they can be marketed. The safety of cosmeceutical products will be the responsibility of manufacturers, and regulatory bodies such as BPOM could take juristic action if the product does not meet safety requirements (Smartlegal, 2020; *Lembaga Bantuan Hukum Pengayoman*, 2021). The greatest concern is that consumers nowadays are attracted to so-called "natural" products, though not all products from nature give benefits and are without side effects (NIH, 2021). Another arising concern is that while the "beauty" industry is at its peak, many false claims and fake promises are made, deceiving the public into buying products although it is not proven beneficial scientifically (Frey, 2020). These reasons highlight the importance of cosmetic testing before launching the product into the market. Moreover, conducting preliminary experiments on cosmetic products could also benefit the manufacturers by securing the brand's reputation. If the product turns out to be non-beneficial, the manufacturer could find a way to improve it by changing the product

¹ Neither the product name nor its formula will be revealed due to the mutual non-disclosure agreement

formulation (Smartlegal, 2020). This research is conducted to validate the safety and anti-aging benefits of Serum E.

This research highlights the assessment of the anti-aging capacity of Serum E towards primary human dermal fibroblast (HDF) as an *in vitro* model through extracellular matrix (ECM) expression studies. The dermis layer of human skin is composed of fiber-rich connective tissue that allows the extensibility and elasticity of the skin (Tortora & Derrickson, 2017). Fibroblast cells located in the dermal layer of the skin are known to secrete ECM, which is crucial to maintaining the skin's structure (Menon et al., 2009). Fibroblast-secreted ECM, including collagen type I, collagen type III, elastin, and hyaluronic acid, serves as an excellent marker for anti-aging activities since their expression is positively correlated with skin elasticity, integrity, volume, and hydration (Kusindarta & Wihadmadyatami, 2018; Kular et al., 2014; Meza et al., 2020; Frantz et al., 2010). To date, there is no argument concerning the fact that the true anti-aging benefit can be accomplished by targeting the dermal matrix (Menon et al., 2009). Therefore, studying ECM expression of HDF through enzyme-linked immunosorbent assay (ELISA) may provide evidence for Serum E anti-aging activities at the molecular level. Prior to ECM analysis, the products were tested for any cytotoxicity. It is hypothesized that Serum E exerted minimum or no cytotoxic effect on the HDF cell line. In addition, it is hypothesized that treatment with Serum E could increase the extracellular concentration of collagen type I, collagen type III, elastin, and hyaluronic acid.

1.2. Research objective

This research can help shed light on the anti-aging effect of topically-applied Serum E. The objective of this study would be to investigate and analyze the anti-aging effect of Serum E on HDF cell lines. Listed below are several objectives that are created to achieve the set aim:

- To determine the effect of Serum E on the viability of HDF cells;

- To determine the anti-aging effect of Serum E based on the level of collagen type I, collagen type III, elastin, and hyaluronic acid secreted by HDF cells.

1.3. Research scope

The study revolves within the field of biomedical sciences, specifically in the research of skin aging and its preventative measures with topically applied skincare products, namely serum. The study will be performed at Indonesia International Institute of Life Sciences. The scope of work of this study can be broken down into five main activities:

- a. Maintaining HDF cell culture
- b. Treatment of cells with Serum E, which will be divided into:
 - Treatment of cells with Serum E whole product
 - Treatment of cells with the base/excipient of Serum E
 - Treatment of cells with active pharmaceutical ingredients (API) of Serum E
- c. Determination of cytotoxicity of Serum E towards HDF cell line by conducting cell viability assay
- d. Measurement of extracellular matrix expression through enzyme-linked immunosorbent assay (ELISA)