

4. THE POTENTIAL OF FISHBONE FLOURS AS AN ANTI-AGING INGREDIENT

As time goes by human will become older as we called it 'aging'. Due to aging, all physiological functions will be degraded. Aging is a process characterized by a gradual loss of physiological integrity, leading to the death of almost all physiological functions and increased vulnerability to death (Lenart & Krejci, 2016). Along with aging, The density of bones will begin to lose and this process may lead to a disease called osteoporosis. Loss of bone mass such as Osteoporosis is a common sign of aging which millions of people suffered (Soltan, 2013). Osteoporosis is related to the deficiency of bone solidity causing the bone to lose its power and becoming porous which makes it easy to become fractures. This disease usually occurs in women after menopause as the result of bone metabolism degradation. In menopause state, women will lose minerals in their bones rapidly because the bone loss its mass and ability to absorb minerals causing osteoporosis to happen (Masyitha, 2006). Consumption of foods rich in calcium is effective to prevent or postpone osteoporosis (Chaimongkol, 2012).

Phosphorus and calcium are major minerals that can be found in fishbone. These two minerals are great for promoting and maintaining bone strength. Unfortunately, these two minerals are not easy to absorb into the bloodstream. However, Fish collagen can support the absorption process of calcium and other minerals that vital for bone strength (Xu Yajun, 2010). The organic matrix in human bones is 90% made up of collagen. The consumption of fish collagen can help promotes cells to build the bone matrix because it contains osteoblast that can help to regenerate and heal human bones (Yamada, 2013).

Fishbone Powder is rich in calcium and suitable to use as a calcium supplement and fortification for the enrichment of the food products because of its characteristics which are a form of fine particle size powder, white color, without any undesirable fishy odor, inexpensive, and environmentally friendly (Mahnaz, 2017). This statement is supported by Bung-Orn Hemung (2013) that the major component of Tilapia bone powder was an ash with white powder color, less moisture, and fat contents. According to Ahmad Talib (2017), fishbone flour contains a high amount of nutrients which can be used as an ingredient of medicine in the future. Supported by the study of Amitha (2019) that extracted fish bone powder is nutritious and can contribute significantly to human health requirements.

According to Mustafa (2012), The extract of snakehead fish has the potential as an anti-aging agent because it influences tissue synthesis, accelerates the process of wound healing, inhibits

free radical production, and increase levels of albumin in hypoalbuminemia. The collagen extract from *Clarias batrachus* can accelerate wound healing because it increased cell adhesion, migration, and proliferation of fibroblast in the mouse's skin (Leong, 2015).

Fish collagen has the best bioavailability and absorption because it has the smallest particle size and the lowest molecular weight out of all other collagen types. Although fish collagen mostly made up of Type I collagen, it's not inferior compare with bovine collagen which made by Type I and Type III collagen (Silvipriya, 2015). Type I collagen is known as skin's best friend because 70% of skin made up of it and it can be found everywhere in the human body except cartilaginous tissue. There are a lot of advantages that we can get from Type I collagen which are reversing the aging process, decreasing the prominence of wrinkles and cellulite, enhancing skin hydration, smoothness, elasticity, suppleness, and firmness for skin (Proksch, 2014). These advantages can cause by the high amino acid contents in Type I collagen especially glycine and proline.

Glycine is foundational to DNA and RNA strands creation that can block endotoxin and help to transport nutrients for body cells to utilize energy. While, Proline is foundational to the human body's ability to naturally produce its collagen by helping the stimulation of the process within the body. Also, it acts as an antioxidant for the body and prevents cell damage from free radicals. Fish collagen also has an anti-aging function, particularly for the skin. After the age of 21st, Collagen in our skin begins to break down gradually along with time. To maintain their health and replenish their skin, People need to consume Type I collagen continuously (De Luca, 2016).

Collagen is the major component in the dermal matrix of the skin and its part of protein which not only builds but also repairs skin cells so it's really helpful for alleviating scars and ensuring faster healing. Type I collagen also promoting protein synthesis and cell proliferation because collagen can support skin tissue strength by regenerating the extracellular matrix of skin so it can promote regeneration of skin after a multitude of skin injuries and deformations from scratches, burns and scars (Brett, 2008). Pati *et al* (2012) said that 90% of collagen present in the human body is types I collagen which is extensively used for biomedical application. A wound is described as a disruption in the epithelial integrity of skin and disruption of structure and function of underlying normal tissue (Enoch & Leaper, 2008) which the acute one heals in

4 stages that are hemostatic, inflammation, proliferation, and remodeling (Williamson & Harding, 2004).

Collagen as a scaffold to aid in wound healing, facilitate cytokine transportation to reduce inflammation, and promote the proliferation stage in the hope to speed up the healing process (Enoch & Leaper, 2008). Glycine in fish collagen may help stabilize blood sugar in our bodies. Low levels of glycine in the body can lead to insulin resistance which is a major cause of type 2 diabetes (Zhu, 2010). According to Richard Yan-Do (2017), people with type 2 diabetes have been found to have low levels of glycine and in need of supplements from fish collagen-rich with glycine. Hydrolyzed fish collagen consists of bioactive peptides that have antioxidant properties because of the presence of hydrophobic amino acids in the peptide so it held reduction of reactive oxygen species which are unstable molecules containing oxygen that cause the aging of tissues and lead to a higher risk of cancer. This type of fish collagen can boost the immune system and reduce inflammatory responses throughout the body (Aleman, 2011). Bioactive peptides found within fish collagen which have antibacterial properties which particularly consist of peptide collagencin that help inhibit the growth of infections and bacteria which cause disease (Ennaas, 2016).

Hydrolyzed collagen is an effective bioactive ingredient to improve dermal health and slow down the effects of skin aging that can be absorbed easily into human plasma. Oral ingestion of hydrolyzed collagen promotes the growth of fibroblasts and stimulates the production of new collagen type I in the dermis. Daily ingestion of hydrolyzed collagen can make human skin become smoother, softer and its textural properties will be enhanced. Daily intakes of hydrolyzed collagen also decrease the expression levels of matrix metalloproteinase that responsible for collagen breakdown (Aguirre-Cruz, 2020).

Fishbone collagen will change to become fishbone gelatin due to thermal denaturation. Fishbone gelatin contain 5.3-9.6% of Hydroxyproline. Hydrolysis of polypeptides chain in gelatin will increase the Hydroxyproline content (Atma, 2018). According to Li Chan *et al* (2012), gelatin hydrolysate has an inhibitory activity toward dipeptidyl peptidase IV (DPP-IV) that acts as an antidiabetic compound. Tilapia (*Oreochromis niloticus*) gelatin has antiphotaging and antioxidant activity (Sun *et al*, 2013).