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REVIEW ARTICLE "PROTEIN IN FISH MEAT"

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ABSTRACT

Fish is one of the preferred sources of protein because fish contains high protein, composed of essential amino acids. This article aims to get information about the proteins contained in fish meat, ranging from structure, classification, type and content and benefits for the human body. Based on the literature study obtained the following information; The protein structure in fish is unstable due to several factors such as pH, radiation, temperature and organic solvents. Based on the source of protein is categorized into two types, namely animal protein and vegetable protein. Protein structure consists of primary, secondary, tertiary and quaternary structures in which each structure has a different shape of arrangement. The classification of proteins in fish meat is categorized into three, namely myofibril proteins, sarcoplasma and stroma. The composition of the three types of proteins in fish meat consists of 65-75% myofibrils, 20-30% sarcoplasm and 1-3% stroma. The classification of proteins can be based on their function, shape and composition. The function of proteins is as structural compounds, enzymes, hormones, transporters, contraction drivers, body defenses, storage, growth control and propagation of nerve impulses. The type of conjugation protein is a protein that contains other nonprotein compounds. Examples of conjugation proteins are nucleoproteins, glycoproteins, phosphoproteins, chromoproteins or metalloproteins and lipoproteins. The protein content in fish meat varies greatly, this is influenced by the type of fish or its habitat. Protein in fish meat consists of essential or non-essential amino acids that are useful for the body, for example the content of these amino acids, such as lysine, leucine, phenylalanine, methionine, threonine and histidine. Fish protein is very easy to digest so that for the digestive system, especially toddlers whose digestive system is not perfect like adults. The main advantage of fish

protein in comparison with other sources of animal protein is the completeness of the amino acid composition and its ease of digestibility.

Keywords : Fish Meat Protein, protein structure, protein classification, protein type, protein content, essential amino acids, protein benefits.

INTRODUCTION

Proteins are large-molecule complex organic compounds consisting of amino acids linked to each other by peptide bonds. Proteins are polymers of amino acids also called polypeptides. Proteins play an important role in the formation of the structure, function and regulation of the cells of living things and viruses. In cells there are proteins both in the plasma membrane and the internal membrane that make up cell organelles such as mitochondria, endoplasmic reticulum, nucleus and golgi bodies which have different functions depending on the place.

Fish is included in one of the foodstuffs that contain a lot of protein. Fish protein is indispensable by humans because it is easily digested by the body, besides that fish also contains amino acids with almost the same pattern as the amino acid pattern in the human body (Almatsier 2001). Fish contains about 60 – 84% water, proteins about 18 - 30%, fats about 0.1 - 2.2%, carbohydrates 0 - 1% and the rest are vitamins. Fish is a source of energy that is very necessary for the body to support daily activities, which if there is a lack of protein in fish, it can also cause poor health and can increase the risk of infectious diseases, cardiovascular diseases, diabetes, and cancer which are the main causes of death in Indonesia (Ministry of Health 2008).

Fish provide approximately 2/3 of the animal protein required by the human body. In fish protein, there are essential amino acids that are indispensable for the body, where the content of these amino acids varies from type of fish. Proteins in fish meat have a diverse structure, classification, type and function which will be described in the explanation below. This article aims to obtain information about the proteins present in fish meat, from the structure, classification, types as well as the content and benefits for the human body.

Protein Structure

Protein is a macromoleculecule due to its large molecular weight. In general, proteins consist of 20 kinds of amino acids that bind covalently to each other and form

a polypeptide chain. The protein structure itself is unstable to several factors such as pH, radiation, temperature and organic solvents. Based on the source, protein is categorized into two types, namely animal protein and vegetable protein. Animal protein is a protein whose source comes from animals such as milk, eggs and meat. While vegetable protein is a protein produced by plants, both processed and not processed, for example, such as cereals and flour (Sari 2011).

The protein structure consists of primary, secondary, tertiary and quaternary structures. Based on their structure proteins are classified into simple proteins and combined proteins. Simple proteins are proteins that consist only of amino acid molecules while combined proteins are proteins related to compounds not proteins. Examples of combined types of proteins include mucoproteins, lipoproteins and nucleoproteins (Ismail Marzuki, Amirullah, 2010). The following is the structure of protein in fish meat;

Primary Structure

The primary structure in proteins is formed from one polypeptide chain which is a series of amino acids of a certain sequence. This arrangement of primary structures determines the basic properties of various proteins, which in general determine the shape of secondary and tertiary structures. This structure consists of amino acids that are covalently connected to each other through peptide bonds

Secondary Structure

The secondary structure is formed by hydrogen bonds that occur between the groups found on the backbone of the polypeptide chain. The bonds that predominate in forming this structure are hydrogen bonds between side chains that form a certain pattern, which depends on the orientation of the hydrogen bond. There are two types of secondary structures, namely; alpha-helix and beta-sheet.

Tertiary Structure

The tertiary structure of proteins is formed from the combination of various secondary structures. The tertiary structure shows how the polypeptide chain folds itself as a result of the interaction of the side group (R) between amino acids.

Quaternary Structure

Quaternary structure is the overall structure of proteins that is the result of aggregation of polypeptide subunits or tertiary structures. Examples of quaternary structures in proteins such as complete globular proteins composed of four polypeptides

Protein Classification

Fish proteins can be classified into proteins of myofibrils, sarcoplasma and stroma. The composition of the three types of proteins in fish meat consists of 65-75% myofibrils, 20-30% sarcoplasm and 1-3% stroma. In the process of processing this protein is very easy to denature. As for the classification of these three proteins:

Myofibril protein is the part with the largest composition and easily dissolves in salt solutions. This protein consists of myosin, actin, tropomiosin and actomycin (a combination of actin and myosin). Myofibril proteins play a role in the process of coagulation and gel formation, especially from actomiosin. This protein is efficient as an emulsifier because it dissolves easily in salt solutions.

- Solution fibrils (Contractile): actin and myosin.

  Proteins that dissolve in salt solutions and have high ion strength

  however, no solution in water ± 75%.

- Actin is composed of three types of proteins, namely actin/ actinine, tropomiosin and troponin. Tropomiosin is a molecule in the form of a cylindrical rod and composed of 2 polypeptide chains. Troponin is an asymmetric protein composed of 3 sub-units of protein.
- Myosin is asymmetrically shaped (rod) composed of 6 protein subunits. Whole myosin molecules are sensitive to the cutting of erelithic protein enzymes at some point.

Sarcoplasmic protein, this protein consists of albumin, myoalbumin and myoprotein. In this protein is contained a wide variety of water-soluble proteins called myogens. The protein content of sarcoplasma varies depending on the type and habitat of the fish. Usually pelagic fish have a greater sarcoplasm protein content than demersal fish. The main difference between white meat and red meat is its pigment content, where *myoglobin* has become the main pigment found in red meat. Myoglobin is similar to hemoglobin in its smaller form, which is estimated at 1/4 part of the large part of hemoglobin. One molecule of myoglobin it consists of one polypeptide chain consisting of one polypeptide chain consisting of 150 pieces of amino acids.

Stromal protein is the protein with the smallest composition in forming connective tissue. Stromal proteins cannot be extracted with water, alkaline solutions, acid solutions or saline solutions at a concentration of 0.01-0.1 M. These proteins have high ionic strength. Stroma protein consists of collagen and elastin which are found

outside the red meat muscle cells of fish. When compared to white meat of fish, stroma cells are more abundant in red meat of fish. The red meat of the fish itself is found along the lower side body of the skin, while the white meat of the fish is found almost all parts of the fish body. This protein comes from *connective tissues*. 3.0% Hard-boned fish. ± 10% Cartilaginous fish.

To classify proteins is a little more difficult because proteins are quite complex macromolecules. Therefore, several categories are needed to classify proteins.

Function

The first category is based on the biological function of proteins. Protein itself has many functions that the body really needs in every living thing. The classification of proteins by their functions is as follows:

a. Structure

Serves to give the shape of the structure as a reinforcement to the tissues of the body. Examples are collagen, elastin, and keratin

b. Contractile

Serves as an aid to the locomotor or contraction process. Examples are actin and myosin.

c. Carrier

Plays the role of transporting important substances throughout the body. Examples such as hemoglobin, myoglobin and lipoproteins

d. Storage

Serves as a place to store nutrients in the body. Examples are casein, ovalbumin, and ferritin

e. Hormones

Acts as a regulator and stimulant for the continuation of biochemical reactions. Examples are insulin and growth hormone.

f. Enzymes

Serves as a catalyst in biochemical reactions in cells. Examples are sucrose and trypsin.

g. Defense

This protein plays a role in recognizing and eradicating foreign substances. Examples are immunoglobulins, fibrinogens and thrombin

h. Poisons

Proteins that are toxic to other living beings.

Shape

Proteins have a variety of forms, so they can be used to classify proteins by their shape.

a. Globular

This protein has a rounded or elliptical shape. The Globular structure has a fold-shaped polypeptide chain with hydrophilic amino acids on the outside. This structure is known for its water-soluble properties. An example is transport proteins.

b. Fiber

This protein is shaped like a fiber or fiber made of polypeptide chains. Proteins of this form are insoluble in water. The role of this protein is to form structures and provide strength and protection for tissues and cells. Examples are collagen, keratin and other structure-forming proteins.

Composition

The composition of proteins is divided into two, namely simple proteins and conjugated proteins. Simple proteins are composed of amino acid bonds and have no other chemical groups. Conjugated proteins must be attached to other groups to play an active role.

Types of Protein

Fish proteins are composed of various amino acids and contain many essential amino acids. Based on the type, amino acids consist of about 22 main types of amino acids. Ten of them are essential amino acids, the following types: phenylalanine, tryptophan, tyrosine, methionine, valine, leucine, isoleucine, lysine, arginine, and histidine. Types of proteins can be categorized based on their function, namely as follows;

Proteins as structural compounds

Collagen is the most abundant protein in the mammalian body (25%), the main component of skin tissue and connective tissue.

Keratin is a protein that is an important component in hair, hair, and nails contained cytoskeleton, namely in intermediate filaments.

- Elastin is a protein found in the shg joints that can stretch in two directions.

Proteins as enzymes

- Enzymes are biocatalystators or catalysts of various biochemical reactions

Protein as a hormone

- Not all hormones are protein compounds or peptides, some are steroid compounds.
- Hormones secreted by the hypothalamus, pituitary and pancreas are all peptide hormones. Insulin is one example of a peptide hormone.

Protein as a transporter

- Hemoglobin is one example of a protein that acts as a transport molecule in the blood, a carrier of oxygen to all cells that require it.
- Meoglobin transports oxygen in the muscles.

Proteins as contraction drivers

- Muscle and cell motility involve interactions between cell motion proteins i.e. actin (actin filaments, the result of polymerization of a sub unit called G-actin) and myosin (the largest motion protein and its length is 150 nm).

Protein as a defense of the body

- Antibodies are one of the body's defense tools, are immunoglobulin molecules, are proteins composed of several polypeptide chains.

Protein as storage

- As a food reserve needed for growth and development.

Proteins as growth controllers

- This protein works as a receptor (in bacteria) that can affect the functioning of parts of DNA that regulate the nature and character of the material.

Proteins as a medium for propagation of nerve impulses

- Proteins that have this function are usually in the form of receptors, for example rodopsin, a protein that acts as a receptor that receives color or light on eye cells.

Conjugation Proteins

- Proteins containing other nonprotein compounds. Examples of conjugation proteins are nucleoproteins, glycoproteins, phosphoproteins, chromoproteins or metalloproteins and lipoproteins.

Protein Content and Benefits in Fish Meat.

The protein content in fish meat varies greatly, this depends on the type of fish or habitat. Based on their habitat, fish that live in natural river waters have higher protein levels compared to fish from floating nets. The high protein content in fish meat turns out to produce a more savory taste. Protein in fish meat consists of amino acids necessary by the human body, both essential and non-essential amino acids. Amino

acids contained in fish meat proteins are organic compounds containing one or more amino groups and one or more carboxyl groups. As for the essential amino acids contained in fish meat, namely;

1. **Lysine**, has the role of forming collagen, muscle tissue and the center of growth hormone production.
2. **Leucine**, this essential amino acid has many roles, such as helping the wound healing process, producing growth hormone, increasing muscle strength, as well as regulating blood sugar levels. One of the fish that is high in leucine content is salmon.
3. **Phenylalanine**, can help the formation of catecholamines, which are substances that function to improve memory, *mood*, mental focus and can help suppress appetite to be regular.
4. **Methionine**, plays a role in lowering blood cholesterol levels, removing toxins in the liver organs and forming regeneration of new tissues in the kidneys and liver.
5. **Threonine**, this amino acid can help strengthen bones and teeth, the high threonine content is found in tilapia and tuna.
6. **Histidine**, plays a role in the development and maintenance of various body tissues, including nervous tissue, this amino acid can be found in cod.

The following is the protein content of several types of fish per 100 gr taken from the source of the list of food compositions, including the following:

- Salmon: 19.9 grams
- Mackerel: 21.4 grams
- Cob Fish: 24 grams
- Snapper: 24 grams
- Mackerel: 21.4 grams
- Pomfret: 18.2 grams
- Whitefish: 14.8 grams
- Catfish: 14.8 grams
- Goldfish: 18.3 grams
- Eel: 21.4 grams
- Cue Fish: 13 grams
- Wader Fish: 14.8 grams
- Mujair fish: 18.2 grams

The protein contained in fish meat is higher than the cereal protein in legumes. Fish protein is equivalent to meat but slightly below the protein content of eggs. Fish protein is so easy to digest that it is good for toddlers whose digestive system is not as perfect as adults. The main advantage of fish protein in comparison with other sources of animal protein is the completeness of the amino acid composition and its ease of digestibility. Given the large role of nutrition for health, fish is the right choice to support a healthy lifestyle.

CONCLUSION

From the discussion that has been described above, it can be concluded that several material points regarding protein in fish meat, namely as follows;

- The protein structure in fish is unstable due to several factors such as pH, radiation, temperature and organic solvents. Based on the source, protein is categorized into two types, namely animal protein and vegetable protein. The protein structure consists of primary, secondary, tertiary and quaternary structures in which each structure has a form of different arrangement.
- The classification of proteins in fish meat is categorized into three, namely myofibril, sarcoplasm and stromal proteins. The composition of all three types of proteins in fish meat consists of 65-75% myofibrils, 20-30% sarcoplasma and 1-3% stroma. The classification of proteins can be based on their function, form as well as composition.
- For the type of protein in fish meat can be seen based on their respective functions where the types are very diverse. The functions of such proteins consist of:
    1. Proteins as structural compounds
    2. Protein as an enzyme
    3. Protein as a hormone
    4. Protein as a transporter
    5. Proteins as contraction drivers
    6. Protein as a defense of the body
    7. Protein as storage
    8. Protein as a growth controller
    9. Proteins as a medium for propagation of nerve impulses

    The type of conjugation protein is a protein that contains other nonprotein compounds. Examples of conjugation proteins are nucleoproteins,

glycoproteins, phosphoproteins, chromoproteins or metalloproteins and lipoproteins.

- The protein content in fish meat varies greatly, this is influenced by the type of fish or its habitat. Protein in fish meat consists of essential or non-essential amino acids that are useful for the body, for example the content of these amino acids, such as lysine, leucine, phenylalanine, methionine, threonine and histidine.
- Fish protein is very easy to digest so for the digestive system, especially toddlers whose digestive system is not perfect like adults. The main advantages of fish protein compared to other sources of animal protein are the completeness of the composition of amino acids and their ease of digestibility.

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