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Review article "LIPID COMPOUNDS IN FISH"

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Abstract

Fish is an excellent source of food for humans. One of the chemical compounds present in fish is lipids. This article aims to obtain information on the types of lipid compounds and fat sam found in fish and the benefits of omega 3 and 6 on humans. Based on the literature review as mentioned above, information was obtained that fats / lipids are a group of food components which are usually known as phospholipids, triacylglycerols, sterols, waxes, and others which are insoluble compounds by water. The meat of fish that belongs to the low-fat group is white, while those belonging to the high-fat group are white to dark. Lipids in fish have higher omega-3 fatty acids compared to other sources. The types of fatty acids found in fish are more numerous than those found in the meat of terrestrial animals. Fish meat is very easy to undergo an oxidation process because it contains a lot of unsaturated fatty acids. Therefore, rancid odors often arise on the body of fish, especially in processed and preserved products that are stored without the use of packaging and antioxidants. The human body can form several types of fatty acids, however, the intake of essential fatty acids, especially omega-3 and omega-6 unsaturated fatty acids, is still needed to increase immunity, lower the risk of coronary heart disease, inhibit the growth of some types of cancer, and maintain brain function especially those related to memory.

Keywords : omega 3, fatty acids, cholesterol, heart, health.

INTRODUCTION

Lipids or fats are organic compounds that are found in many tissue cells, insoluble in water, soluble in non-polar solvents such as (ether, chloroform, and benzene). Lipids are non polar or hydrophobic. Lipids include heterogeneous compounds present in plant and animal tissues, one of the groups that play an important role in nutrition is fats and oils. Fat is stored in the animal's body, while oil is stored in plant tissues as an energy reserve. The main constituents of lipids are triglycerides, which are glycerol esters with three fatty acids that can be of various types. Lipids are components of plasma membranes, hormones, and vitamins.

There are two kinds of lipid constituent fatty acids, namely saturated fatty acids and unsaturated fatty acids. Unsaturated fatty acids have a double bond on their carbon chain. Halogens can react quickly with C atoms on chains whose bonds are not saturated (addition events). The functions of lipids, including as a constituent of cell membrane structure, energy reserves, storage and transport can also act as protectors of cell wall components.

Fish are usually classified by their fat content. Fats/lipids are a group of dietary components commonly known as phospholipids, triacylglycerols, sterols, waxes, and others that are insoluble compounds by water. Variations in lipid content are strongly influenced by gender, size and stage of the reproductive cycle. The lipid content of fish can describe the temperature at which it lives, fish from cold waters its lipid content can reach three times that of those in warm waters. This article aims to obtain information on the types of lipid compounds and fat sam contained in thisarea as well as the benefits of omega 3 and 6 on humans.

Types of Lipid Compounds in Fish

Fish are usually classified by their fat content. Fats/lipids are a group of dietary components commonly known as phospholipids, triacylglycerols, sterols, waxes, and others that are insoluble compounds by water. Fish are classified as low-fat fish if they contain less than 2% lipids; medium-fat fish contain 2−5% lipids and high-fat fish contain lipids above 5%, and there are even fish that contain up to 20% lipids, namely lemuru fish from the Straits of Bali. The meat of fish that belongs to the low-fat group is white, while those belonging to the high-fat group are white to dark. Variations in lipid content are strongly influenced by gender, size and stage of the reproductive cycle. Crab meat and shrimp have a very low lipid content, even less than 1%.

Lipids in fish have higher omega-3 fatty acids compared to other sources. Omega-3 fatty acids have the ability to reduce the risk of heart disease. Energy is generally stored in the form of triglycerides. The lipid composition of freshwater fish is to be between land mammals and marine fish. Freshwater fish contain more omega-6 unsaturated fatty acids, which is about 15% of total fatty acids, and contain fewer omega-3 fatty acids than marine fish. Therefore, the ratio of omega-3 fatty acids to omega-6 fatty acids can be used to distinguish between freshwater fish and marine fish, that is, the ratio is 0.5–4 for freshwater fish and 5–15 for marine fish, respectively. Cultured fish lipids contain more omega-6 fatty acids and fewer omega-3 fatty acids compared to fish living in the wild.

There are two types of important omega-3 fatty acids, namely eicosypentanoic acid (C20:5) commonly known as EPA *(eicosapentanoic acid)* and docosahexanoic acid known as DHA *(docosahexanoic acid).* EPA is typically found in marine algae, while DHA is derived from zooplankton. The proportion between the two types of fatty acids depends largely on the type of food consumed by fish.

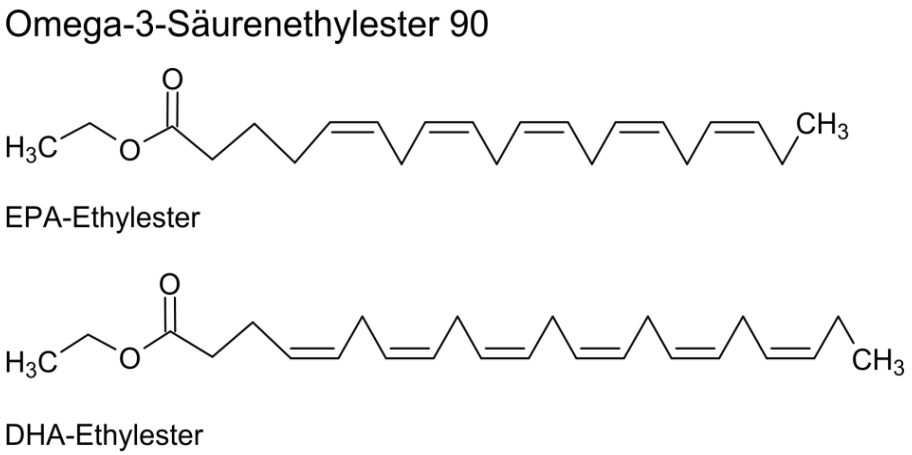

Figure 1. Chemical structure of Omega 3 found in Fish

The lipid content of fish can describe the temperature at which it lives, fish from cold waters its lipid content can reach three times that of those in warm waters. In fish individuals, the lipid content increases from tail to head with increased deposition of fat on the abdomen and red meat. Some types of fish whose fat content is affected by their egg-laying cycle. In low-fat fish, the amount of triglycerides stored in meat is small, but often the liver is high in fat and can be used as a good source of vitamins A and D. Lipids in meat also contribute to the flavor of the fish. Lipids themselves have little taste, but their important role is the tendency to produce unwanted flavors due to influences from the environment, such as the occurrence of rancidity due to oxidation reactions.

Fish and some shellfish (lobsters and crabs) eat other animals so it can be estimated that the sterols identified are cholesterol, while mollusks and some crustaceans rely heavily on organisms in their aquatic environment, so some of the sterols present are sterols-noncholesterols derived from algae plants. Using a new analytical technique, it was shown that mollusks contain only 50 mg/100g of cholesterol, much lower than the expected level of content in shellfish which causes some to recommend not to avoid shellfish on their food menu. The content of phospholipids is usually no more than 1% by weight of tissues. The fraction of phospholipids is relatively stable, its number and composition are independent of food and other factors (MPA 2019).

Types of Fatty Acids contained in Fish Meat

The fat content contained in fish only ranges from 1-20%, especially most of the fat content is in the form of unsaturated fatty acids that are beneficial to the body, including functioning to lower cholesterol levels in the blood (Andriani and Bambang 2012).

The types of fatty acids found in fish are more numerous than those found in the meat of terrestrial animals. Fish meat glue contains saturated fatty acids with a chain length of C14 – C22 and unsaturated fatty acids with a number of bonds of 1 – 6. The fats of terrestrial animals contain only some types of saturated fatty acids and unsaturated fatty acids. The average fish fat has a biological value, for example, the biological value of sardines reaches 98.1. The high biological value of fats is due to several factors, including:

a. The first group is oleic acid which can provide the highest biological figures, so this acid is classified as an essential fatty acid.

b. The second group is given by low molecular weight fatty acids, such as lauric, myristic, capric, and caprylic acids.

c. The lowest is given by linoleic acid.

Although fish meat contains quite high fat (0.1 – 2.2 %), but because 25% of this amount is unsaturated fatty acids that are needed by humans and cholesterol levels are very low, fish meat is not harmful to humans, as well as to people who are over-cholesterol.

Free fatty acids are also found in fish meat, meaning they are not bound as esters, the amount is small, namely 0.1 – 0.4% only. More than 25 kinds of fatty acids are found in fish meat. It generally consists of high molecular weight fatty acids with a total of 17-21% saturated fatty acids and 79-83% of all fatty acids in fish meat.

Fish meat is very easy to undergo an oxidation process because it contains a lot of unsaturated fatty acids. Therefore, rancid odors often arise on the body of fish, especially in processed and preserved products that are stored without the use of packaging and antioxidants.

Table 1. Fatty Acid Content in Fish

Fatty Acids	**Content (%) and Total Acid Weight**
Saturated	
Mirusites	5-7
Palmitate	10-20
Strearat	1-3
Unsaturated	
Arachidonat	18-22
Clupanodonate	7-15
Erucat	12-16
Godoleat	10-18
Linoleic and linoleic	10-18
Oleic	7-8
Zoomerat	10-12

Seafood contains omega-3 unsaturated fatty acids, *Eicosa pentaenoic Acid* (EPA) and *Docosahexaenoid Acid* (DHA) which are very high. The omega-3 content in fish is much higher than other animal protein sources, such as beef and chicken, pork does not even contain omega 33 at all. The human body can form several types of fatty acids, however, the intake of essential fatty acids, especially omega-3 and omega-6 unsaturated fatty acids, is still necessary. The main sources of omega-3s are seafood and crops such as soybeans, canola and flaxseed. While the main source of omega-3 is also found in all types of seafood such as crustaceans, mollusca, fish and plants such as sunflower, corn and soybeans (MPA 2009).

Benefits of Omega 3 and 6 against Humans

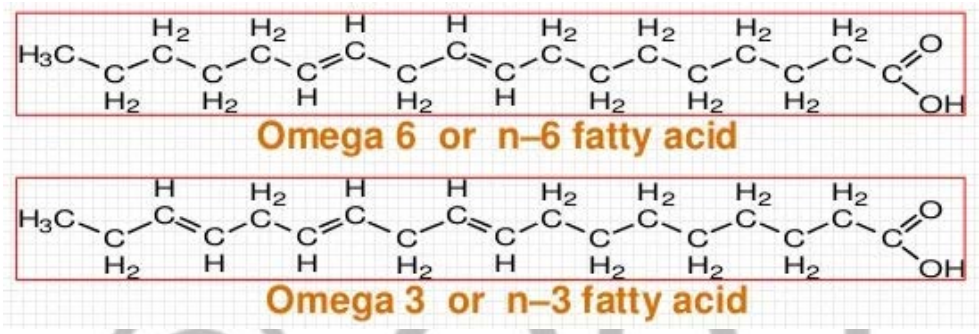

Figure 2. Omega 3 and 6 structure

Omega 3 and omega 6 are fatty acids and fatty acids are a carboxylic bond with aliphatic bonds that can be both saturated and unsaturated. Fatty acids are the basis of fat builders (lipids) and are the main constituent components of fats. Fats are included in nutrients; so do proteins, carbohydrates, vitamins, and minerals. Fat is one of the nutrients needed by humans. In the human body, fats are divided into 2 groups, namely structural fats and functional fats. Structural fats are part of the cell wall while functional fats are in the form of steroid hormones, prostaglandins, and fat deposits that can be used as energy reserves (Garrow and James 1993).

Table 2. Omega 3 and 6 Content in Various Types of Fish per 100 grams

Jenis Ikan	Omega 3 (gr)	Omega 6 (gr)
Sardine	1,2	2,2
Tuna	2,1	3,2
Kembung	5,0	3,0
Salmon	1,6	2,1
Tenggiri	2,6	3,7
Tongkol	1,5	1,8
Teri	1,4	1,6

Source : (Astawan 2005)

One of the benefits of consuming fish is that it can lower blood cholesterol levels, lower blood triglyceride levels, increase children's intelligence and improve academic abilities, reduce the risk of death due to heart disease, reduce rheumatic symptoms, reduce the growth activity of cancer cells and also contain omega 3 and omega 6. Omega 3 found in fish prevents heart disease and other degenerative diseases. People who like to consume fish have a longer average life expectancy than people who consume less fish (Pandit 2008).

Some of the benefits that we can get from consuming omega 3 are as supporting factors in the development of cell membranes in the neurological system of our brain and signaling pathways. It has been scientifically proven that omega 3 helps brain development and memory for both children and adults. Research shows that omega 3 can prevent heart disease and other heart-related diseases. This is because omega 3 increases the elasticity of the arteries. Lowers the risk of arrhythmias (abnormal heartbeat) and also high blood pressure. A study found that regular consumption of fish rich in omega 3 was shown to increase good cholesterol and lower levels of triglycerides (fats in the blood).

The high content of omega 3 fatty acids plays a role in increasing immunity, lowering the risk of coronary heart disease, inhibiting the growth of several types of cancer, and maintaining brain function, especially those related to memory (Andriani and Bambang 2012).

Conclusion

Based on the literature review as mentioned above, information was obtained that fats / lipids are a group of food components which are usually known as phospholipids, triacylglycerols, sterols, waxes, and others which are insoluble compounds by water. The meat of fish that belongs to the low-fat group is white, while those belonging to the high-fat group are white to dark. Lipids in fish have higher omega-3 fatty acids compared to other sources. The types of fatty acids found in fish are more numerous than those found in the meat of terrestrial animals. Fish meat is very easy to undergo an oxidation process because it contains a lot of unsaturated fatty acids. Therefore, rancid odors often arise on the body of fish, especially in processed and preserved products that are stored without the use of packaging and antioxidants. The human body can form several types of fatty acids, however, the intake of essential fatty acids, especially omega-3 and omega-6 unsaturated fatty acids, is still needed to

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