Global Scientific JOURNALS

GSJ: Volume 10, Issue 2, February 2022, Online: ISSN 2320-9186
www.globalscientificjournal.com

EATING HABITS AND DIGESTIVE SYSTEM OF FISH

[1]Fittrie Meyllianawaty Pratiwy, [2]Sheila Zallesa [3]Juli A Sinaga

[1]*Departemen of fisheries, fisheries and marine science faculty, Universitas Padjadjaran, Indonesia*
[2]*Departement of Marine, Fisheries and marine science faculty, Universitas Padjadjaran, Indonesia*
[3]*Alumni of Fisheries Study Program, Fisheries and marine science faculty, Universitas Padjadjaran, Indonesia*

Corresponding Author : fittrie.pratiwy@unpad.ac.id

KeyWords
Anatomy, Classification, Digestion, Eating habit, Enzymes, Fish, Process, Proteins

ABSTRACT

Fish is a food rich in protein, fat, vitamins, and beneficial minerals. Fish protein has advantages over other food ingredients because of its complete amino acid composition and ease of digest. To study the nutrition of Fish, it is necessary to know about the digestive process. Digestion is the process by which digested food nutrients such as proteins, lipids, and carbohydrates are broken down into units small enough to be absorbed across the intestinal wall. This process is achieved through the action of digestive enzymes. Enzymes that aid in protein digestion are known as proteases. For the digestion of carbohydrates, the enzymes involved are carbohydrates. The enzymes lipase and phospholipase facilitate digestion of lipids. Fish's eating habits and behaviour refers to the process of searching for and consuming food. Fish can be classified according to their diet or the food they usually eat, namely herbivores, carnivores, omnivores, planktivorous, and detritivores. Classification of Fish based on the behaviour of eating Fish according to the way they eat, namely predators, grazers, strainers, suckers, and parasites. Fish also adapt to differences in their diet by anatomy and behaviour. There is a strong correlation between the anatomical structure of the digestive tract and the eating habits of Fish.

Keywords: Fish Habits, Eating Habits, Diggestive System, Herbivorous, Carnivorous, Omnivorous

Introduction

Fish is a marine product that contains long-chain fatty acids: omega-3 (DHA), which land products (animal and vegetable) lack, and even omega-6, which play a very significant role in growth and health (Wahyuni, 2001 in Dewi et al. al., 2018). Fish is one of the foodstuffs with higher protein absorption than other animal products such as beef and chicken. Fish protein has the advantage of amino acids' composition is complete and easy to digest. As a good source of protein, Fish

has a process to digest the food it consumes through its digestive system.

To study the nutrition of Fish, it is necessary to know about the digestive process. The relationship between physiology, digestion, nutrition, and growth is interrelated because an understanding of digestive physiology is needed for the development of fish farming. Digestion of food through physical and chemical mechanisms is a food simplification process that aims to make food easily absorbed and spread through the circulatory system throughout the body.

Feeding habits and behaviour in Fish

Fish's eating habits and behaviour refers to the process of searching for and consuming food. It also includes ways and stimuli to eat. Fish can be classified according to their diet and diet; Herbivores (plant eaters), Carnivores (meat eaters), Omnivores (eaters of everything or plants and meat), Planktivorous (eaters of plankton, microscopic plants, and aquatic animals including bacteria), and Detritivores (eaters of decaying matter). Other classifications of fish-eating behaviour according to the way of eating, among others; Predators are Fish that eat microscopic animals, Grazers eat basic organisms or selectively consumed plankton, Strainers are those that filter organisms, especially diatoms and crustaceans from the water, Suckers are those that suck mud or food-bearing material to obtain their food, and Parasites such as lampreys and hagfish, differ greatly from other finfish in their behaviour. They receive nutrition by sucking the body fluids of the host fish.

Anatomy and Physiology of the Digestive System in Fish

Fish adapt to their different diets in anatomical and behavioural ways. Thus, there are many differences in Fish's anatomy and physiology of digestion. There is a strong correlation between the anatomical structure of the digestive tract and the eating habits of Fish. Herbivorous Fish that depend on fibrous foods such as phytoplankton and macrophytes differ anatomically and behaviourally from carnivorous Fish that eat meat and other more easily digestible feeds. Nikolsky (1963) stated that the relative gut length for carnivorous Fish < 1, for omnivorous Fish between 1 – 3, while for herbivorous Fish> 3. According to Kramer and Bryant (1995), that the range of gut length for carnivorous Fish is 0.5- 2.4 times body length, omnivorous Fish 0.8-5 times body length, and herbivorous Fish have intestines between 2-21 times body length. Generally, carnivorous Fish have pointed teeth, relatively short intestines, eat meat or animals, thick intestinal walls and gill filters that are not tight. On the other hand, Herbivorous Fish have accessory masticatory apparatus or other physiological adaptations to help break down plant cell walls before digestion begins and long, thin intestines to increase intestinal retention time and promote digestion and absorption (Pratiwy & Kohbara, .

The entire digestive tract is often referred to as the intestine, and in Fish, the intestine usually has four divisions: the head gut, foregut, midgut, and hindgut. The head gut, the most anterior part, includes the mouth (oral or

buccal cavity) and gills (branch cavity or pharynx). The foregut begins at the posterior edge of the gills and consists of the exophages, stomach, and stomach. If present, the middle intestine consists of the intestine and the pyloric caeca. The midgut is the longest part of the intestine and can be rolled into a complicated loop. The hindgut includes the enlarged portion of the intestine and the rectum or anus. Each part of the intestine has a highly variable structure for adaptation. The liver and pancreas are organs involved in digestion but are outside the tubular structures.

The liver aids digestion by secreting bile, a greenish liquid with solid emulsifying properties. Bile serves to emulsify lipids in the intestine and may contain other waste products. The liver is also a storage organ for stored lipids and glycogen or starch. Meanwhile, the pancreas is involved in many essential functions of indigestion. The pancreas produces insulin and digestive secretions, especially proteases and bicarbonate. Insulin stimulates the absorption of amino acids from the intestine and can stimulate the growth.

Digestion and Absorption in Fish

Digestion is the process by which digested food nutrients such as proteins, lipids, and complex carbohydrates are broken down into units small enough to be absorbed across the intestinal wall. This process is achieved through the action of digestive enzymes. The ability of fish to digest feed depends on the secretion of the appropriate type of enzyme in sufficient quantities. Many enzymes are stored in an inactive or proenzyme form. Once secreted into a favourable environment for digestion, usually influenced by pH, this inactive enzyme is converted into an active form that is ready to perform its specific digestive function. When various nutrients have been adequately digested, they are then absorbed mainly in the middle intestine.

There are several mechanisms of nutrient absorption in fish—simple diffusion, active transport, and pinocytosis. In simple diffusion, a solute passes through a membrane from an environment of high to low solute concentration without using energy. Active transport differs from simple diffusion in that it requires a continuous supply of energy and transports solutes in only one direction from low to high solute concentration. Carrier systems that utilize Na+ and ATPase activity are required for the active transport of glucose and some amino acids. Pinocytosis (cell drinking) is the process by which materials are brought into the cell by invagination and subsequent dissolution of parts of the cell membrane. This process allows cells to absorb some proteins and lipids in their intact form.

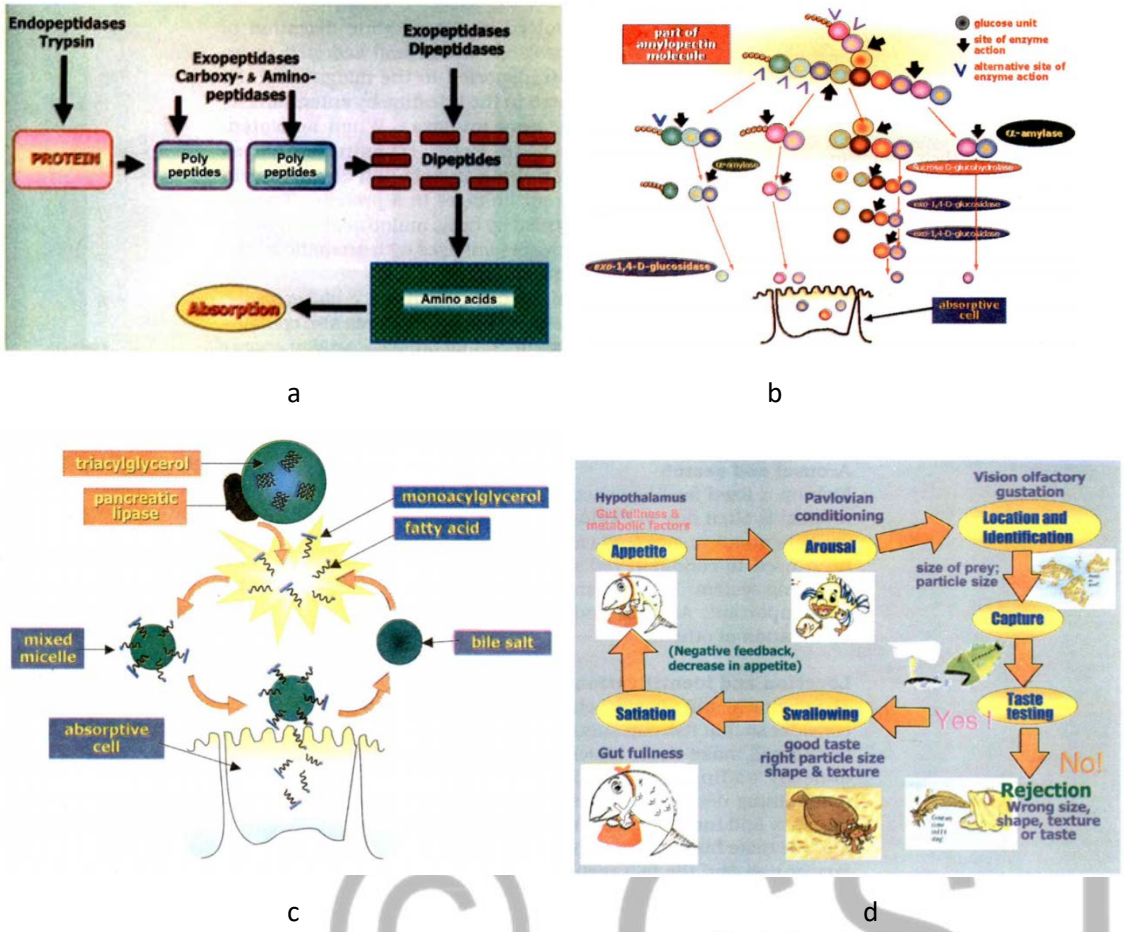

Figure 1. Digestion and absorption in fish; protein digestion(a), carbohydrate digestion and absorption (b), lipid digestion and absorption (c); and The process of feeding fish, Knight (1985) (d).

Feed composition, digestibility, and preparation affect digestion and absorption. Dietary fiber is highly indigestible in non-herbivores due to the absence of the enzymes needed to break down the complex cell walls found in feed. Roughage is high in fiber, so its use is limited in practical feeds for non-herbivores. Vegetable proteins are known to vary in their digestibility in fish due to differences in amino acid composition and secondary and tertiary structures of protein. In addition, if certain types of feed are known to pass quickly through the animal's digestive tract, they will not be digested properly due to inadequate exposure to digestive enzymes.

Conclusion

The eating habits and behaviour of fish refers to the process of finding and consuming food. Fish can be classified according to their diet or the food they usually eat as herbivores, carnivores, omnivores, planktivorous and detritivores. A classification based on how to eat or get food includes predators, grazers, strainers, suckers, and parasites. Fish also adapt to their different diets in anatomical and behavioral ways. There is a strong correlation between the anatomical structure of the digestive tract and the eating habits of fish. Digestion is the process by which digested food nutrients such as

proteins, lipids, and carbohydrates are broken down into units small enough to be absorbed across the intestinal wall. This process is achieved through the action of digestive enzymes. Enzymes that aid in protein digestion are known as proteases. For the digestion of carbohydrates, the enzymes involved are carbohydrates. Digestion of lipids is facilitated by the enzymes lipase and phospholipase.

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