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A REVIEW ON NUTRITIONAL STUDIES ON FISH *CATLA CATLA* FOUND IN GANGA RIVER WITH HYDROBIOLOGICAL STUDIES

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Abstract

A literature review of nutritional studies on fish *Catla catla* found in Ganga river with hydrobiological studies is a piece of academic writing that summarizes and evaluates the existing literature on the topic. It also identifies the gaps, controversies, and limitations in the literature, and highlights the significance and implications of the research question or problem. Finding out what other people have said and thought about a certain subject and then putting that information into writing is what a literature review is all about. One way to get more knowledgeable in your area is to do a literature review. Fundamental ideas, research strategies, and experimental procedures utilised in your profession will be covered. Discover real-world challenges. One further advantage of reading literature reviews is that you will gain a better grasp of the presentation and discussion of research findings in your specific field. Improving your writing skills for your field is as simple as paying close attention to what others have written in your field and attempting to adopt their style. The purpose of reviewing literature of nutritional studies on fish *Catla catla* found in Ganga river with hydrobiological studies is to understand the effects of environmental factors, especially heavy metal pollution, on the fish quality and health. *Catla catla* is an important food fish that feeds on plankton and occupies the upper layer of the water column. It is widely distributed in India and other South Asian countries. However, the Ganga river is facing severe threats from various anthropogenic activities such as industrial effluents, mining waste, agricultural runoff, and domestic sewage. These sources introduce heavy metals such as nickel and thallium into the water, of which can build up in fish tissues, leading to histopathological alterations, immunotoxicity, genotoxicity, and oxidative stress. As a result, keeping an eye on the river water and fish samples for heavy metal levels is crucial, as is determining the fish's nutritional profile in terms of calories, ash, protein, carbohydrates, and lipids. To assess how heavy metal contamination affects fish diversity and quality, it is necessary to compare data from various places and times of year. Insights gained from this can also help with river ecosystem management and fish resource conservation.Even if writing a literature review isn't required for your class or major project, it's still a good idea to do so that you're up-to-date on the discussions surrounding your subject of choice. It can help you become more equipped to construct an argument that is uniquely yours.

Keywords : *Catla catla*, metal contamination, industrial effluents, pollution, Ganga river

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Introduction

Fish is an essential part of human life, an important source of protein and provides some useful products and financial health for many countries. The gradual erosion of commercial fish due to overfishing and habitat change is one of the reasons for the emergence of the science of fish biology. It is well known that knowledge of fish biology, especially knowledge of morphometry, distribution of the body, knowledge of eating in the body, as well as the use of knowledge, increases the success of fish entrepreneurs. To improve agriculture, it is necessary to understand their population, that is, how fast they grow and multiply, the size and age of their eggs; deaths and their causes affect the food they eat and other biological processes.Fish are winged, cold-blooded, gill vertebrates. Their body structure is similar to humans and other vertebrates (bony). Fish, like other vertebrates, breathe oxygen, eat, move, reproduce, and sense their environment, but only in water. More than 20,000 known vertebrate species are fish. Ninety percent of them are in the class Osteichthyes or bony fish. One of the fish species that is widely consumed in India and other South Asian countries is Catla catla, a freshwater fish that belongs to the family Cyprinidae. It is commonly known as catla, katla, or major carp. It is a planktivorous fish that feeds mainly on phytoplankton, zooplankton, and detritus. It occupies the upper layer of the water column and prefers warm and turbid waters. Catla fish is beneficial for human health as it can help prevent or reduce the risk of various diseases, such as arthritis, cardiovascular diseases, anemia, and osteoporosis. It can also improve the immune system, brain function, and skin health. However, catla fish may also contain some contaminants, such as heavy metals, pesticides, and pathogens that can pose a threat to human health

Chondrichthyes, which include stingrays, sharks, and fish with cartilaginous skeletons, make up the bulk of that 10%. The third category of fishes, the extinct Agnatha (meaning "jawless"), included the lamprey and the hagfish, two of the largest fishes in the ocean. It all depends on the species, the size of the fish, and the type of food they eat, but most fish have a torpedo form. Typically, fast-swimming fish have a long, slim body and strong fins that allow them to travel at speeds of up to 50 m/s. H. in the open ocean, also known as the pelagic environment. Bluefin tuna, when swimming in and out of kelp forests and coral reefs, little fish use their broad bodies and pliability of fins to catch prey and evade predators. In their early stages, flounders resemble tiny fish. However, as they mature, they develop a lateral flattening of the body and a lateral eye movement. Fish spend their entire lives as pets, swimming alongside creatures with their beaks outstretched, as they mature into little specimens of adults.

Some fish, such as the garden eel, live in tubes in the sand and have snake-like bodies. When threatened by predators, they hide on ships but come out of the ships to feed on zooplankton, except for the tip of their tails. The 4,444 garden eels are tight-lipped and fight for a place to eat, leaving each eel on its neighbour's long trunk. All eels look like they are in a garden while they are eating. Fins give the fish movement, balance and maneuverability. Fins may or may not be paired. The dorsal and anal fins are articulated fins that act as spines to prevent the fish from rolling. The tail or caudal fin is not yet together and helps support and stabilize the fish. The pelvic and pectoral fins are always together, which allows the fish to turn, balance and stop. The steerable and flexible pairs of fins provide better control at low speeds, while the rigid fins act as a steering plane for the fish to swim fast. The fins and bodies of bony fish are covered with skin made up of thousands of tiny scales. The growth of the fish is marked with a year around each scale, and the size and shape of the scales varies from fish to fish. Therefore, examining the scales can tell researchers not only which fish species produced the scales, but also how many specialized fish. Mucus coats the skin and scales of fish bones, so fish feel slimy, but mucus is very important because it protects fish from diseases, predators, parasites, and sunburn. The skin of cartilaginous fish, however, is very different, thick and hard, like armor rather than mucus, and covered with small, impermeable scales. Sharks and their relatives have scales called denticles (like teeth) and skin that looks like sandpaper.Nutritional studies on fish Catlacatla found in Ganga river with hydrobiological studies are that aim to analyze the nutritional value, biochemical composition, and food habits of Catlacatla, a freshwater fish species that is widely consumed in India and other South Asian countries. Hydrobiological studies are studies that investigate the biological aspects of aquatic ecosystems, such as the diversity, distribution, ecology, and physiology of aquatic organisms. These studies also examine the effects of environmental factors, such as temperature, salinity, oxygen, pH, and pollutants, on the aquatic life. Characters can molt multiple times at a rapid rate given adequate food and proper care. Food should be of good quality as well as rich. Although research on crustacean nutrition is not as good as that of trout and eels, it is now clear that lipid play an important role as energy for crustacean growth and that the four non-fatty acids (HUFA) are a food composition. Animals-like animals are particularly important. These are linoleic acids, linoleic eicosapentaenoic acid and docsahexaenoic acid. There is evidence that growth is inhibited if the diet is deficient or lipid-free. What are needed in the nutrition of the body are carbohydrates, proteins, fats, water, mineral salts and vitamins. The first three requirements are for energy and appliances. The next three are useful for design and policing. There are also organic substances such as choline. In foods, sterols, purines, and pyrimidines are also required. Food is an anabolic process, it is holozoic in most animals and animals are heterotrophs.

About 250 kilometres of the middle Ganga River's course through the Uttar Pradeshi districts of Kanpur, Allahabad, Varanasi, and Mirzapur made up the research area. Located on the banks of the Ganga River, Allahabad is a prominent city on the way to Kanpur and Varanasi. Among Allahabad's three primary fish landing areas—Daraganj, Sadiyapur, and Jhunsi—three in Varanasi—Rajghat, Saraimohana, and Ramnagar—the bridge area in Kanpur—Unnao's Shuklaganj—and Mirzapur district's Adalhat—are also important. The pH is one of the most important factors that affect aquatic life in any body of water. The pH of water can be changed by a variety of solutes, some of which are organic and others inorganic. According to this research, the pH levels change from 8.1 to 8.4 before the monsoon and from 7.3 to 8.2 after the rains have stopped.Between Gangamahal Ghat and Shivala Ghat, the minimum and highest inflows of the Ganga River were 5.30 and 7.3 (mg L-1, respectively). The concentration of these DO values is higher than what is recommended by BIS. The water in the various ghats and Ganges is unfit for human consumption and other uses due to its high content of dissolved oxygen. Weather variations are just one of several physical and chemical variables that impact zooplankton community dispersion. Other effects include changes in water temperature, ph, dissolved oxygen, and nitrate.the results demonstrated that the distribution and quantity of zooplankton were affected by the physical and chemical parameters of the water and were time-dependent. *Catla catla* is a planktivorous fish that feeds mainly on phytoplankton, zooplankton, and detritus. Protein is an important nutrient for human health, as it helps in building and repairing tissues, muscles, and organs. *Catla catla* is a good source of protein, as well as omega-3 fatty acids, vitamin B1 and B12, and calcium. The zooplankton species and physical and chemical characteristics of the Ganga river make it an ideal location for fish farming. The physical and chemical parameters are within acceptable ranges, and the zooplankton biomass and composition are uniformly distributed. Zooplankton populations peaked in the summer and declined after the monsoon. The pollution of Ganga River water using fish as bioindicator, and examines the activities of superoxide dismutase, catalase, level of lipid peroxidation, activities of transaminases enzymes, and alkaline phosphatase in certain tissues of the carp labeo rohita collected from the Ganga River. It shows that the fish suffer from oxidative stress, cellular damage, and impaired metabolism due to the polluted condition of the river water. It also suggests some remedial measures to improve the water quality and the fish health.Water quality on the growth and survival of *Catla catla* in earthen ponds. It measures the water parameters, such as temperature, ph, dissolved oxygen, total alkalinity, total hardness, ammonia, nitrite, nitrate, phosphate, and chlorophyll-a, in four ponds with different stocking densities and feeding regimes. It shows that the water quality deteriorates with the increase of stocking density and feeding rate, and affects the growth and survival

of *Catla catla*. It also shows that the water quality can be improved by using biofertilizers and probiotics. The pollution of Ganga River water using fish as bioindicator, and examines the activities of superoxide dismutase, catalase, level of lipid peroxidation, activities of transaminases enzymes, and alkaline phosphatase in certain tissues of the carp Labeo rohita collected from the Ganga River. It shows that the fish suffer from oxidative stress, cellular damage, and impaired metabolism due to the polluted condition of the river water. It also suggests some remedial measures to improve the water quality and the fish health.

Definition, Importance and Relevance

A literature review is a piece of academic writing that demonstrates your knowledge and understanding of the existing literature on a specific topic or subject. It also includes a critical evaluation of the sources and their relevance, quality, and contribution to your research. A literature review can be a standalone assignment or a part of a larger project, such as a dissertation or a research paper. The purpose of a literature review is to:

•Summarize and synthesize the main arguments and findings of thesources.

•Identify the gaps, controversies, and limitations in the literature.

•Highlight the significance and implications of your research question or problem.

•Situate your research within the context of the existing literature and show how it contributes to the field.

The purpose of such a literature review is to:

•Understand the effects of environmental factors, especially heavy metal pollution, on the fish quality and health.

•Assess the nutritional profile of the fish in terms of moisture, ash, protein, carbohydrate, lipid, and energy.

•Compare the results from different locations and seasons along the Ganga River.

•Evaluate the impact of heavy metal pollution on the fish diversity and quality.

•Provide information for the conservation and management of the fish resources and the river ecosystem.

A literature review is a comprehensive and critical survey of the existing literature on a specific topic or research question. It helps the researcher to:

Provide context and background for the research problem and justify its significance and relevance.

Identify the gaps, controversies, and limitations in the current knowledge and show how the research aims to address them.

Demonstrate familiarity and expertise with the relevant literature and the main arguments and findings of the sources.

Establish the theoretical framework and/or the research methodology that guide the research design and analysis.

Compare and contrast different perspectives, approaches, and methods in the literature and evaluate their strengths and weaknesses. Synthesize and integrate the information from the sources and present a coherent and logical argument or narrative. Acknowledge the sources and avoid plagiarism by using proper citations and references. It helps the researcher to: Provide context and background for the research problem and justify its significance and relevance; identify the gaps, controversies, and limitations in the current knowledge and show how the research aims to address them; Demonstrate familiarity and expertise with the relevant literature and the main arguments and findings of the sources;

•Establish the theoretical framework and/or the research methodology that guide the research design and analysis;

•Compare and contrast different perspectives, approaches, and methods in the literature and evaluate their strengths and weaknesses;

•Synthesize and integrate the information from the sources and present a coherent and logical argument or narrative;

•Acknowledge the sources and avoid plagiarism by using proper citations and references.

A literature review is not just a summary of the sources, but a critical and analytical evaluation of them. It shows the reader how the research is built on the existing knowledge and how it contributes to the field. A well-written literature review can enhance the quality, credibility, and originality of the research.

Review of Important Research Work

Saravanan *et al*. (2003) found that pollution has a deleterious effect on the fish fauna of the Cauvery River, leading to a decrease in species diversity. In a lotic body of water in the Indo-Himalayan area, Bhushan *et al*. (2005) conducted a qualitative and quantitative investigation of the planktonic abundance.Vosylienė *et al*. (2006) tested how a heavy metal mixture affected the biological parameters of rainbow trout, Kulkarni *et al.* (2007) examined how arsenic affected the enzymes of Labeo rohita, the rohu carp. Thakur *et al*. (2007) conducted a physicochemical study on effluent water collected from Bihar's industrial belt.The highest amount of endemism and fish diversity was found in the Ganga, the biggest river basin in Asia, according to De Silva *et al*. (2007). An increase in algal photosynthesis leading to the precipitation of carbonates of magnesium and calcium from bicarbonates may explain why summertime pH values are so high, according to research by Prakash *et al.* (2007).

The effects of hexavalent chromium on the behaviour and histology of the gill, kidney, and liver of the freshwater fish Channa punctatus (Bloch) were examined by Mishra *et al*. (2008). For their 2009 study, Vinodhini *et al*. investigated how harmful heavy metals affected the haematological parameters of common carp (Cyprinus carpio L.).In the Haridwar district, Joshi *et al.* (2009) calculated the physicochemical properties of the Ganga River water using statistical methods. Seasonal and temporal changes in physico-chemical and bacteriological features of the Ganga River near Ghazipur were described by Mishra *et al*. (2009).

In a comprehensive study undertaken by Joshi *et al*. (2009), the water quality index of the Ganga River in the Haridwar district was evaluated. Ninety water samples were collected from five different sites and tested for various physico-chemical parameters, including temperature, velocity, pH, dissolved oxygen, free CO_2, COD, BOD, carbonate, bicarbonate, total alkalinity, hardness, turbidity, calcium, magnesium, sodium, potassium, nitrate, phosphate, chloride, sulphate, electrical conductivity, total dissolved solids, and total suspended solids. In the middle and lower sections of the Yangtze River basin, Yujun *et al*. (2011) conducted an ecological risk assessment of heavy metals in sediment and an assessment of human health risk in fish.The river Ganga's water quality near Gazipur was investigated by Yadav and Srivastava (2011). The researchers Ravichandran *et al*. (2011) found 1.2% fat in their study. Among three distinct fish species, the estimated fat content was 0.64% in Ophiocephalus punctatus, 1.08% in Heteropneustes fossilis, and 1.23 in Channa striatus.The protein content of two species of freshwater fish, *Catla catla* and O. mossambicus, was reported by Ravichandran *et al*. (2011), with values ranging from 19.72% to 22.84%. Standard techniques

parameters such as pH, EC, and turbidity were measured in-situ when four sampling stations were analysed by Sharma *et al*. (2011) downstream of Hoshangabad city.According to Bhuvaneshwari *et al.* (2012), the Parastromateus niger fish from the Cauvery River can be used as a bio-indicator species for zinc pollution in aquatic environments since it has a greater zinc concentration as a result of river pollution. Research by Afsar *et al*. (2012) examined the recovery of metlate dehydrogenase activity in Anabus testudineus, a freshwater fish poisoned with lead.According to Kromhout *et al*. (2012), fish is rich in protein and contains several important nutrients, including vitamins, minerals, and fatty acids. When compared to a group that didn't eat fishes at all, those who ate fish once a week had a far lower risk of coronary heart disease. The effect of the insecticide monocrotophos on the oxygen consumption of freshwater fish was investigated by Shivkumar *et al*. (2013). Research on the bioaccumulation of several heavy metals and hemostatic indices in a subset of the freshwater in the Manyara River, Nigeria, was conducted by Moody *et al*. (2013).Fish were found to be affected by several forms of heavy metal contamination, as noted by Ali *et al.* (2014).

In contrast to the pH levels suggested by the World Health Organisation, Pandey *et al*. (2014) found higher pH values (8.29) in the Ganga water at Daraganj ghat, Allahabad. The water quality of the lower Ganga River in India was the subject of research by Sukumaran *et al*. (2014).Research on the phytoplankton diversity in the Ganga River in Allahabad, Uttar Pradesh, India, was conducted by Shukla *et al*. (2015).

With a focus on zinc and cadmium, Rani *et al.* (2015) assessed the toxicity of heavy metals in fish. Researchers Thoker *et al*. (2016) looked at the effects of Malathion toxicity on the biochemical alterations in the kidneys of the fish Channa punctatus (Bloch). Yelwa and Solomon (2016) investigated the impact of catfish (Clarias gariepinus) length and weight on electrolyte levels. When exposed to heavy metal-laden wastewater, Channa punctatus showed a number of biomarker responses, including serum biochemistry, oxidative stress, genotoxicity, and histopathology (Mehjbeen *et al*., 2017). Ahmed *et al.* (2018) looked at the arsenic levels in regularly eaten foods in Bangladesh to see what kind of harm it could pose to people's health.Agata *et al.* (2019) tested various biological reactors to determine how well they treated wastewater from fish processing.When suspended sediments scatter light instead of transmitting it throughout the water, a phenomenon known as turbidity occurs (Sebasti A-Frasquet *et al*., 2019). Studying snow trout (Schizothorax labiatus) in the Indian Himalayan Region, Jan *et al*. (2020) determined that sex and season affect some haematological and biochemical parameters.Pandit*et al.* (2020) studied the zooplankton ecology and diversity in relation to water quality along the Ganga River in Bihar, India. Copper oxide nanoparticles were found by Abdel-Latif *et al.* (2021) to affect serum biochemical indices, histopathological changes, and the transcription of cytokines, hsp70, and oxidative stress genes in Oreochromis niloticus. The haematological and serum biochemical analytes of snow trout, Schizothorax esocinus that inhabit Dal Lake were found to vary seasonally by Reshi *et al*., (2022). In order to measure the health of Himalayan snow trout, Schizothorax esocinus, Mushtaq *et al*. (2023) looked at the blood and serum biochemical reference intervals and indexed them.In 2006, Shinde and Chaudhary tested the groundwater and P.H.E. tap water in Jhabua (M.P.) to determine their potability as drinking water sources. Biomaterials were found to be effective in the removal of alizarins red sulphur (Dye) from dye waste water by Dudhnath*et al*., (2007).Effluent water from Bihar's industrial belt was analysed physicochemically by Thakur*et al*., (2007). According to Dural *et al*. (2007), heavy metal accumulation is higher in organs that actively metabolise them, such as the gill, liver, and kidney, compared to other tissues, such as muscle.

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