OPEN ACCESS
Haya: The Saudi Journal of Life Sciences
Abbreviated Key Title: Haya Saudi J Life Sci
ISSN 2415-623X (Print) |ISSN 2415-6221 (Online)
Scholars Middle East Publishers, Dubai, United Arab Emirates
Journal homepage: https://saudijournals.com

Review Article

Zoological Parameters Associated with Fish Nutrition and Strategies to Increase Their Valuable Food Production

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DOI: 10.36348/sjls.2021.v06i07.006 | **Received:** 13.06.2021 | **Accepted:** 09.07.2021 | **Published:** 20.07.2021

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Abstract

There are different ingredients employed in right composition for fish foods that can be processed through sequential analysis of proteins, lipids, carbohydrate and other minerals based compounds. Fish wastes have become a major problem in the modern era due to accumulation of toxic compounds that released through animal wastes. There are different methods to store the fish foods for long periods of time. Contaminated foods leads to death of many fishes due to excess level of heavy metals such as mercury, arsenic and other environmental pollutants that causes degradation of fish's internal parts. Beef also in crushed form also used a source of foods in many fish populations. Freezing of the foods is better option options as compared to the strategies for food storage as it maintain the internal pH and temperature of the nutrients by supplying them regulate heat flow in order to spillage of foods. This review focus on the foods used for fishes and animals inhabit in watery environments, source, nutritional value and biochemical aspects on the fish health's. Phytoplanktons are used as ideal source of foods for most varieties of fishes because they are composed of proteins, lipids, minerals and also other useful nutritional value.

Keywords: Fish nutrition, vitamins, biological importance, toxic wastes, technological strategies.

INTRODUCTION

Different types of foods are used as a source to survive in different environments. There are different methods to store the fish foods for long periods of time [1]. Foods that stored at the right time can be used as nutritional requirements of fish foods. Contaminated foods leads to death of many fishes due to excess level of heavy metals such as mercury, arsenic and other environmental pollutants that causes degradation of fish's internal parts [2]. It also leads to reduction in fish pollution. There is need to designed the good managing strategies of fish foods that can be stored for a couple of months as a stock. It also increases the chances to fish farmers that also better adaptation of increasing the fish populations [3].

Fish foods comprised lots of organisms of animal family such as shrimp, blood worms and many other sea animals that required for adequate growth and development in watery environment [4]. Beef also in crushed form also used a source of foods in many fish populations. But contaminated foods leads to toxicity in fish thus need better strategies [5]. There is specific pH and temperature on which food can be stored at the industrial level. It has huge impact on the aquaculture industry that prepared the foods for fish in order to increase their breeding and population in well appropriate manner [6].

Foods for fish and other animals inhabit in water can be stored in frozen form, solid as well as powdery form [3, 5]. Freezing of the foods is better option options as compared to the strategies for food storage as it maintain the internal pH and temperature of the nutrients by supplying them regulate heat flow in order to spillage of foods[7]. Solid form of form also used in aquaculture and fishes but sometimes it becomes polluted due to agree contamination eatery some of pathogens such as bacterial and other microbial strains. Higher concentrations of microbes in the foods lead to spillage of foods. If a spoiled food directly feeds to the fishes and animals of watery environments, it leads to deaths of fishes and natural habitat animals [8].

This review focus on the foods used for fishes and animals inhabit in watery environments, source, nutritional value and biochemical aspects on the fish health's [9]. Some of the data or literature missing in strategies for fish nutrient and composition of foods stored in order to spoil before processing in safe environments. Animals and other sources are also used as foods for fish foods have been discussed in this review in order to store the different parameters affecting on the fish health [10].

Table-1: Shows the nature of compounds, its nutritional value and biological significance

Name of compound	Nutritional Value (%)	Biological significance	Reference
Fats and other soluble compounds	7	Helpful for transporting the lipids based compounds across the cells	[19]
Proteins	70	Maintenance the tissue repairing	[16]
Fibres	1	Role in digestion	[12]
Amino Acids	6	Maintenance the structural and functional properties	[8]
Minerals	4	Aids in digestion, fluids transport	[19]
Other commands	4	Maintenance the electrolyte balance and fluids balance	[20]
xanthophyll's	10	Assistant in pigment of fish coloring	[21]

Nutritional Aspects of Fish Food

Phytoplanktons are used as ideal source of foods for most varieties of fishes. They are composed of proteins, lipids, minerals and also other useful nutritional value [11]. Due to high quality of these food nutrients, they are regard for food for most of aquatic animals [12]. But when present in large enough, they produce colored patches on the water surface because of the presence of chlorophyll, phycobiliproteins or xanthophylls in their cells. They are the ideal food for fish. Sometimes, they release toxins that bromes unfit for food for animals foods. There is need to purify the different types of nutrients in order to collect them from different sources [13].

Sometimes, proteins sources are useful as a source of food from marine species due to large nutritional value such as high quantity of proteins and lipids in the form of egg yolk[14]. Shrimp as well as rotifers are also collected by animal's farmers and used for fish food before selling into the market, passing them through purification and final refinement[]. Marine species such as sea bass, sea bream, flounders and turbot consume the nutrition in their yolk sacs during the first few days post hatching and then are fed for several weeks on live prey in the form of rotifers and brine shrimp [15].

There are different ingredients employed in right composition for fish foods that can be processed through sequential analysis of proteins, lipids, carbohydrate and other minerals based compounds. Sources of protein are typically fishmeal, created from other fish [16]. Other sources of protein include legumes such as soybean. They added the right proportion ratio of foods utilized for most of species [17]. These macro and macromolecules give high amount of energy used by fishes and other aquatic animals. Protein requirement can be vary for different fish species. For most types of fish feed, protein will be the most expensive ingredient. There is need to design such kind of strategies that empowers the balanced diet for animals that potentially increase the chances of fish production [18].

Advances in Fish Food and Wastes removal strategies

Fish wastes have become a major problem in the modern era due to accumulation of toxic compounds that released through animal wastes [20]. Overfeeding of fishes also leads too excess destruction of many aquatic animals due to water disposal directly into their seas and rivers [21]. Toxin metals such as leads, mercury and arsenic leads to death of many fishes. The high level of toxic ammonia, nitrite, or nitrate levels are going up and the tank seems polluted, it probably overfeeding the fish [22].

There is need to design strategies to control such kind of wastes. It depends upon on the within two conditions [29]. High filtration discs are used to control their wastewater disposal. Failure and infiltration working of filtration disks leads to increase the pollution in nearby areas where fish and aquatic animals wastes that kills them [23].

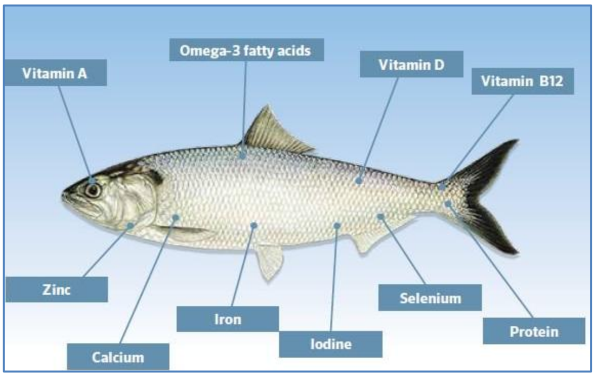

Fig-1: Shows the zoological nutritional aspects associate with fish

Biological strategies to improve the quality of Fish Foods

Different biological strategies to be adapted to involve the ecological relationship among different species in order to increase the production as varieties of different animals used as foods [24]. Despite the ecological importance of predatory pelagic fish species, information and data on these species in the Mediterranean Sea is limited [25]. Different species contents such as Xiphias glades, little tunny, Euthynnus alliterates and Atlantic bonito, Sarda sarda are used as source of food to enhance the muti nutritional aspects of staple foods [26].

Different strategies to be adopted in order to increase the nutritional value of foods for fishes [27]. One of such strategy is to establish the relationship between different sectors for giving the farmers incentives to practice more sustainable aquaculture shrimp farmers operating legally in aquaculture zones with access to free training, water supply, and wastewater. Thus, it enhanced the production of different varieties of animals used for foods especially fishes [28]. Sometimes, microbes also plating significant role in distraction of food.

There are different ways to increase the market value of fish feeds through advanced strategies by increasing the supply of crabs, shrimp and other sea foods [29]. The most important criteria is the market value and demand of the fish or shrimp species to be farmed; the market value dictating the profit margin relative to production costs, including the cost of feeding[30]. Taking care of shrimp, sea animals in right way leads to significant production of feeds for fish. It also helpful for storage of foods for fish. Advanced freezing technologies, storage of foods in solid form also helpful to increase the market value of foods that can be used as a stock for long periods of time also in cases when there is shortage of food supply[31-34].

CONCLUSION

Fish foods contains a lot of essential minerals, vitamins and have significant value as compared to the other animal feeds that are too costly and not affordable. Biological strategies such as wastes removal and effective preparing of fish foods leads to foundation for industrial predations of actively high quality proteins diet with minimum weightage of waste. It also helpful to improve the food market value of fish foods.

REFERENCES

1. Mauerwerk, M. T., Zadinelo, I. V., & Meurer, F. (2020). Use of glycerol in fish nutrition: a review. Reviews in Aquaculture.
2. Li, X., Zheng, S., & Wu, G. (2020). Nutrition and metabolism of glutamate and glutamine in fish. Amino acids, 52, 671-691.
3. Gasco, L., Acuti, G., Bani, P., Dalle Zotte, A., Danieli, P. P., De Angelis, A., ... & Roncarati, A. (2020). Insect and fish by-products as sustainable alternatives to conventional animal proteins in animal nutrition. Italian Journal of Animal Science, 19(1), 360-372.
4. Reksten, A. M., Somasundaram, T., Kjellevold, M., Nordhagen, A., Bøkevoll, A., Pincus, L. M., ... & Aakre, I. (2020). Nutrient composition of 19 fish species from Sri Lanka and potential contribution to food and nutrition security. Journal of Food Composition and Analysis, 91, 103508.
5. Li, X. Y., Zheng, S. X., & Wu, G. (2020). Nutrition and functions of amino acids in fish. Adv Exp Med Biol, 1285, 133-168.
6. Choi, D. G., He, M., Fang, H., Wang, X. L., Li, X. Q., & Leng, X. J. (2020). Replacement of fish meal with two fermented soybean meals in diets for rainbow trout (Oncorhynchus mykiss). Aquaculture Nutrition, 26(1), 37-46.
7. Deshpande, G. C., & Cai, W. (2020). Use of lipids in neonates requiring parenteral nutrition. Journal of Parenteral and Enteral Nutrition, 44, S45-S54.
8. von Danwitz, A., & Schulz, C. (2020). Effects of dietary rapeseed glucosinolates, sinapic acid and phytic acid on feed intake, growth performance and fish health in turbot (Psetta maxima L.). Aquaculture, 516, 734624.
9. Wanja, D. W., Mbuthia, P. G., Waruiru, R. M., Mwadime, J. M., Bebora, L. C., Nyaga, P. N., & Ngowi, H. A. (2020). Fish husbandry practices and water quality in central Kenya: potential risk factors for fish mortality and infectious diseases. Veterinary medicine international, 2020.
10. Fisher, H. J., Collins, S. A., Hanson, C., Mason, B., Colombo, S. M., & Anderson, D. M. (2020). Black soldier fly larvae meal as a protein source in low fish meal diets for Atlantic salmon (Salmo salar). Aquaculture, 521, 734978.
11. Aman, F., & Masood, S. (2020). How Nutrition can help to fight against COVID-19 Pandemic. Pakistan Journal of Medical Sciences, 36(COVID19-S4), S121.
12. Corzo, L., Fernández-Novoa, L., Carrera, I., Martínez, O., Rodríguez, S., Alejo, R., & Cacabelos, R. (2020). Nutrition, health, and disease: Role of selected marine and vegetal nutraceuticals. Nutrients, 12(3), 747.
13. Manooch, I. I. I., & Charles, S. (1977). Foods of the red porgy, Pagrus pagrus Linnaeus (Pisces: Sparidae), from North Carolina and South Carolina. Bulletin of Marine Science, 27(4), 776-787.
14. Garrison, L. P., & Link, J. S. (2000). Dietary guild structure of the fish community in the Northeast United States continental shelf ecosystem. Marine Ecology Progress Series, 202, 231-240.
15. Deraniyagala, S. P., Perera, W. V. S. M., & Fernando, W. S. (2000). Iodine in fish and crabs

from Sri Lankan waters. Journal of the National Science Foundation of Sri Lanka, 28(3).
16. Mazumder, D., Saintilan, N., & Williams, R. J. (2006). Trophic relationships between itinerant fish and crab larvae in a temperate Australian saltmarsh. Marine and Freshwater Research, 57(2), 193-199.
17. Carrick, R. (1959). The food and feeding habits of the Straw-necked Ibis, Threskiornis spinicollis (Jameson), and the White Ibis, T. molucca (Cuvier) in Australia. CSIRO Wildlife Research, 4(1), 69-92.
18. Ropes, J. W. (1989). The food habits of five crab species at Pettaquamscutt River, Rhode Island. Fishery Bulletin, 87(1), 197-204.
19. Chen, C. Y., Stemberger, R. S., Klaue, B., Blum, J. D., Pickhardt, P. C., & Folt, C. L. (2000). Accumulation of heavy metals in food web components across a gradient of lakes. Limnology and Oceanography, 45(7), 1525-1536.
20. Richards, M. P., Pettitt, P. B., Stiner, M. C., & Trinkaus, E. (2001). Stable isotope evidence for increasing dietary breadth in the European mid-Upper Paleolithic. Proceedings of the National Academy of Sciences, 98(11), 6528-6532.
21. Megrey, B. A., Rose, K. A., Klumb, R. A., Hay, D. E., Werner, F. E., Eslinger, D. L., & Smith, S. L. (2007). A bioenergetics-based population dynamics model of Pacific herring (Clupea harengus pallasi) coupled to a lower trophic level nutrient–phytoplankton–zooplankton model: description, calibration, and sensitivity analysis. Ecological modelling, 202(1-2), 144-164.
22. Chen, C. Y., Stemberger, R. S., Klaue, B., Blum, J. D., Pickhardt, P. C., & Folt, C. L. (2000). Accumulation of heavy metals in food web components across a gradient of lakes. Limnology and Oceanography, 45(7), 1525-1536.
23. Werner, F. E., Ito, S. I., Megrey, B. A., & Kishi, M. J. (2007). Synthesis of the NEMURO model studies and future directions of marine ecosystem modeling. ecological modelling, 202(1-2), 211-223.
24. Marsh, A. G., Leong, P. K., & Manahan, D. T. (1999). Energy metabolism during embryonic development and larval growth of an Antarctic sea urchin. Journal of Experimental Biology, 202(15), 2041-2050.
25. Dabrowski, K. (1992). Ascorbate concentration in fish ontogeny. Journal of Fish Biology, 40(2), 273-279.
26. Vander Zanden, M. J., & Vadeboncoeur, Y. (2002). Fishes as integrators of benthic and pelagic food webs in lakes. Ecology, 83(8), 2152-2161.
27. Banse, K. (1992). Grazing, temporal changes of phytoplankton concentrations, and the microbial loop in the open sea. In Primary productivity and biogeochemical cycles in the sea (pp. 409-440). Springer, Boston, MA.
28. Christoffersen, K. (1996). Ecological implications of cyanobacterial toxins in aquatic food webs. Phycologia, 35(sup6), 42-50.
29. Sommer, U., & Sommer, F. (2006). Cladocerans versus copepods: the cause of contrasting top–down controls on freshwater and marine phytoplankton. Oecologia, 147(2), 183-194.
30. De Laender, F., Van Oevelen, D., Soetaert, K., & Middelburg, J. J. (2010). Carbon transfer in a herbivore-and microbial loop-dominated pelagic food webs in the southern Barents Sea during spring and summer. Marine Ecology Progress Series, 398, 93-107.
31. Müller- Navarra, D. C. (2008). Food web paradigms: the biochemical view on trophic interactions. International Review of Hydrobiology, 93(4- 5), 489-505.
32. Samhouri, J. F., Levin, P. S., & Harvey, C. J. (2009). Quantitative evaluation of marine ecosystem indicator performance using food web models. Ecosystems, 12(8), 1283-1298.
33. Cottingham, K. L., & Schindler, D. E. (2000). Effects of grazer community structure on phytoplankton response to nutrient pulses. Ecology, 81(1), 183-200.
34. Ndebele-Murisa, M. R., Musil, C. F., & Raitt, L. (2010). A review of phytoplankton dynamics in tropical African lakes. South African Journal of Science, 106(1-2), 13-18.