

Hygiene Practices in Seafood: Ensuring Safety and Freshness

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Introduction

Important part of foodborne diseases is related to improper preparation practices in home kitchen. Global concern about food safety has prompted research to evaluate domestic food handling practices and food safety knowledge. Food safety is a featured issue in terms of human health protection. Regulatory agencies control food processing facilities on food safety, but it is the consumer's responsibility to ensure the right conditions at home. Many of the food poisoning cases at home are not reported to the public health authorities and there is little interest in the news media. For this reason, the public generally associates foodborne illnesses with dining out and does not realize the importance of home practices in terms of food safety. Whereas, the number of coliform and faecal coliform bacteria in the home kitchen may be even higher than the toilet. The consumer's practices at home may lead to disadvantages such as cross contamination or bacterial growth, as well as providing benefits such as pathogen reduction via cooking or retarding bacterial growth by cooling. Consumer education about proper practices is of great importance in terms of preventing foodborne poisoning. For an effective communication, the behavioural differences of the people should be determined and a risk communication plan should be made accordingly. Determination of consumer behaviour also leads the industry to improve its applications such as product design, distribution system, packaging, logistics. Thus, it is possible to make a significant contribution to marketing by establishing permanent, mutual and beneficial relationships between suppliers and consumers.

Seafood and foodborne pathogens

Nowadays food poisoning is a major social and scientific issue. Food poisoning is caused by those foods which look normal when we see it, smell normal and even taste normal when we eat it. Only special scientists can analyze food quality by checking its all-sensory parameters. Food poisoning caused by foodborne pathogens. These pathogens can be bacteria, viruses, fungi and algae. Pathogens mostly attack on those foods which are stored in humid environment, high

temperature and which have more water content. According to these conditions' seafood is more susceptible food for contamination. Seafood can be contaminated by pathogens at any stage from harvesting to fork. Sometime fish can become poisonous even in water by some bacteria's or by some algal toxins. Most common pathogens which involve in seafood poisoning are *Vibrio*, *Salmonella*, *Listeria*, *Shigella*, *Staphylococcus*, *Clostridium* and *Escherichia coli*. Poisoning diseases which can occur are scombroid poisoning, amnesic shellfish poisoning and diarrhetic poisoning, etc. Some viruses also involved in seafood born infections. These infections can be avoided by using proper cleanliness and care in handling fish. In this review the most common food-borne pathogens in fish and fish products are discussed

Eating customs vary worldwide and the types of food that people consume vary across 53 countries. People in numerous countries consume ready-to-eat (RTE) and raw food, including 54 seafood products, and these individuals are most vulnerable to foodborne illness. Seafood 55 includes various species of mollusks, marine mammals, finfish, crustaceans, and fish eggs 56. Because seafood is high in nutritional value, containing high-quality 57 proteins, omega-3 fatty acids, essential micronutrients, and certain minerals and vitamins 58, it is increasingly incorporated as a part of a healthy 59 diet worldwide. Recently, the Food and Agriculture Organization (FAO) estimated the amounts of seafood consumed annually: according to the FAOSTAT Database (faostat.fao.org), the 61 largest amount of seafood consumed is in Japan (53.70 kg/person/year), while the consumption 62 in China is 32.80 kg/person/year (FAO, 2014). The FAO declared the USA to be the third-largest 63 seafood consumer in the world (21.70 kg/person/year). An annual report released by the National 64 Oceanic and Atmospheric Administration (NOAA) indicated that commercial fishermen in the 65 USA gathered 9.6 billion pounds of seafood in 2012, which was valued at US\$ 5.1 billion 66 (NOAA, 2011). Furthermore, the world's fish and seafood consumption has grown exponentially 67 over the past few decades from 137 to 143 million metric tons, which is valued at US\$ 208 68 billion (FAO, 2010). Globally, seafood is a major traded food product that is often shipped over 69 long distances (FAO, 2002). As such, a large amount of seafood is imported by the USA each 70 year (FAO, 2009). Concurrent with the increase in consumption of seafood, the disease burden 71 associated with these products increased in the USA between 1998 and 2008. Meanwhile, 72 general awareness of seafood-related illnesses also increased during this period (Morbidity and 73 Mortality Weekly Report (MMWR), 2013). During this 10-year period, seafood-related products, 74 such as finfish, molluscan shellfish, seafood dishes and other seafood products were reported to be responsible for 5,603 cases of diseases that included 657 outbreaks of foodborne illnesses in 76 the USA (Center for Science in the Public Interest (CSPI), 2013). Globally, *Aeromonas* 77 *hydrophila* has been isolated from aquaculture products, including crabs and fishes (Nielson et 78 al., 2001), and

septicemia due to motile *Aeromonas* spp. has been estimated to have caused 79 greater than US\$ 12 million in losses to catfish aquaculture facilities in the USA. Mizan *et al.*,(2015).

Food safety practices in seafood hygiene

Food safety practices in seafood hygiene are critical to preventing contamination and ensuring the safety of consumers. Seafood, due to its high moisture content and perishable nature, is particularly vulnerable to bacterial, viral, and parasitic contamination. To prevent foodborne illnesses, strict hygiene practices must be followed from the moment seafood is harvested until it reaches the consumer.

At the harvesting stage, proper handling and storage are key to preserving the freshness and safety of the product. Fishermen and aquaculture workers must ensure that all equipment, such as nets, boats, and storage containers, is thoroughly cleaned and sanitized before use. Additionally, seafood should be kept at safe temperatures (below 4°C or on ice) immediately after harvest to inhibit bacterial growth. During transportation, seafood must be stored in refrigerated or insulated containers, ensuring that the product remains cool throughout the journey.

Once seafood reaches processing facilities or retail outlets, the hygiene practices become even more critical. All surfaces, tools, and equipment used in processing, such as cutting boards, knives, and packaging materials, should be cleaned and sanitized regularly to prevent cross-contamination between raw and cooked products. Workers in processing plants and retail environments must follow strict personal hygiene protocols, including frequent handwashing and wearing protective gear like gloves and aprons to avoid direct contact with the product.

At home, consumers also play an important role in maintaining seafood hygiene. Raw seafood should always be stored separately from other foods in the fridge to prevent cross-contamination. Hands, cutting boards, and utensils should be thoroughly cleaned before and after handling seafood. Cooking seafood to the proper internal temperature is essential, as this kills harmful bacteria and parasites. For example, fish should reach an internal temperature of 63°C (145°F), while shellfish should be fully cooked until opaque. Following these food safety practices ensures that seafood is safe to eat, preserving both its quality and nutritional value while minimizing health risks.

1.Hygiene During Harvesting and Collection

Microorganisms such as bacteria, viruses, and parasites are in all waters, and can be found on fish and crabs. These microorganisms may come from combined sewer overflows (CSOs*), faulty septic systems, and animal waste. After heavy rains, levels of faecal contamination can be higher in waters. Assume that all waters can have faecal contamination.

In case of raw sewage, avoid fishing by following advice on any sewage-related signs. By keeping hands away from your mouth, eyes, ears, and nose while fishing and cover open wounds

to avoid contact with the water. This reduces the chances of getting sick from microorganisms that can enter into consumers body through these pathways. By washing hands after fishing, especially before eating, and shower if had contact with the water these hygiene practices can be followed during collection and harvesting.

Handling and Preparing Fish

Fish and crabs, even from waters with high levels of microorganisms, can be eaten if you follow these good hygiene practices:

- Only keep fish that act and look healthy.
- Wear nitrile, rubber or plastic protective gloves while gutting, filleting, and skinning the fish. Avoid directly handling and preparing fish when you have cuts or open sores on your hands.
- Remove and discard the guts (internal organs) soon after harvest, and avoid direct contact with the intestinal contents.
- Keep fish cool (with ice or refrigerated below 450 F or 70 C) until filleted and then refrigerate or freeze.
- Wash hands, utensils, and work surfaces before and after handling any raw food, including fish.
- Unlike PCBs, mercury and other chemicals, most microorganisms can be destroyed by cooking. Cook fish thoroughly until internal temperature is 1450 F or until flesh is pearly and opaque and separates easily with a fork Viji *et al.*, (2024).

2. Hygiene During Transportation and Storage

Hygiene during the transportation and storage of seafood is paramount to ensuring both the safety and quality of the product, as seafood is highly susceptible to spoilage and contamination due to its perishable nature. From the moment seafood is harvested until it reaches the consumer, maintaining strict hygiene standards is essential to prevent bacterial growth, preserve freshness, and reduce the risk of foodborne illnesses. During transportation, the seafood must be kept at optimal temperatures—typically between 0°C and 4°C (32°F and 39°F)—to inhibit bacterial growth and maintain its quality. This requires the use of refrigerated transport (such as refrigerated trucks, boats, or containers) equipped with temperature monitoring systems to ensure consistent cold storage throughout the journey. Additionally, ice or gel packs are often used to keep the products cool, especially when transportation times are long. The containers used for transportation should be clean, sanitized, and designed to prevent cross-contamination between different batches of seafood or other food items, as well as to protect the seafood from exposure to any contaminants in the environment.

At the point of arrival, seafood must be promptly moved into appropriate storage conditions. For fresh seafood, cold storage at a temperature close to freezing (0°C to 2°C or 32°F to 36°F) is essential to maintain freshness. For frozen seafood, storage should occur at temperatures of -18°C (0°F) or lower to preserve the quality and prevent thawing, which could encourage bacterial proliferation. All storage facilities, whether cold rooms, freezers, or chillers, must be regularly cleaned and sanitized to prevent the buildup of bacteria or Mold, and temperature

controls should be routinely checked to ensure that the environment is consistently maintained at the required levels. Furthermore, seafood should be stored away from raw meats and other products that could cause cross-contamination. Storage practices should also prevent contact with surfaces that could harbour contaminants, such as floors or unclean shelves. Proper ventilation is also crucial to avoid moisture buildup, which can contribute to spoilage or bacterial growth. The seafood should be stored on pallets or raised surfaces to prevent direct contact with the floor and minimize the risk of contamination.

Labelling and traceability also play an important role in hygiene during storage. Proper documentation that tracks the origin, transportation conditions, and expiration dates of seafood helps to ensure that any quality or safety issues can be identified quickly and addressed. Regular monitoring of hygiene standards, temperature controls, and cleanliness within the storage and transportation environments is necessary to ensure that seafood remains safe for consumption and maintains its desired quality. Adherence to these rigorous hygiene protocols throughout the transportation and storage phases helps to minimize the risk of contamination, preserve the nutritional value and taste of the seafood, and ensure compliance with food safety regulations Trafialek *et al.*, (2016).

Conclusion:

In conclusion, adhering to strict hygiene practices is essential for ensuring the safety and freshness of seafood. From proper personal hygiene for handlers to maintaining clean and sanitized equipment, every step in the seafood supply chain plays a critical role in preventing contamination. Storage hygiene, including appropriate temperature control and separation of raw and cooked products, ensures the integrity of seafood during transportation and retail. Regular cleaning, proper packaging, and compliance with food safety regulations are non-negotiable for maintaining quality. By implementing these measures, seafood businesses can protect consumer health, extend product shelf life, and build trust in their products, highlighting the vital importance of hygiene in the seafood industry.

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