Public health issues in aquaculture

G.L. Jensen (1) & K.J. Greenlees (2)

(1) United States Department of Agriculture, Cooperative State Research, Education and Extension Service, Plant and Animal Production, Protection and Processing, Stop 2220, 1400 Independence Avenue, SW, Washington, DC 20250-2220, United States of America
(2) United States Food and Drug Administration, Center for Veterinary Medicine, Office of New Animal Drug Evaluation, 7500 Standish Place, Rockville, Maryland 20855, United States of America

Summary
The authors address the public health issues associated with the consumption of aquacultural products using numerous examples from the United States of America. As with other foods, public health risks exist but these mostly involve open water environments or products which are consumed raw or undercooked. Unlike wild fisheries, inland aquaculture systems can minimise public health risks by proper site evaluation and good aquacultural practices. Responsible use of pesticides and therapeutants can prevent violative residues to assure product safety and wholesomeness. The implementation of hazard analysis and critical control point regulations will further enhance the preventive approach to hazards control.

The most challenging public health risks arise from shellfish production in open, surface waters, where both naturally-occurring and trace environmental residue contaminants can bioaccumulate in tissues and may cause disease outbreaks (and, in severe cases, death). Water quality certification programmes and field surveillance efforts including product sampling, testing and monitoring can address critical safety criteria. This paper focuses primarily on public health risks associated with production: however, the fact that consumer risks also occur as a result of the processing of aquacultural products and that foodborne diseases arise additionally from unsanitary handling or preparation and storage at incorrect temperatures (as is the case for food products from other animals) must also be taken into consideration.

Keywords

Introduction
Aquaculture, or the farming of water, is a specialised form of agriculture practised throughout the world under varying conditions, ranging from home-use subsistence to large-scale commercial systems. Production occurs in all types of environments, and hundreds of species are cultured world-wide. As the supply of seafood from natural sources diminishes, there is an increasing global focus on aquaculture. As with any agricultural commodity, both actual and potential public health hazards exist. Some of these can be prevented, and others are still unknown because of the lack of science-based human risk assessment information and inadequate diagnostic and detection procedures. Planners and producers can intervene to ‘control or manage’ the aquaculture environment and other factors to minimise public health and safety risks. Proper cleaning, processing, storage, handling and marketing of these highly perishable products, restriction to consumption of properly cooked products, and even attention to sanitary operating procedures, will minimise potential safety hazards. Health problems may arise when abuse of regulations and carelessness occur. Other public health risks in some locations are linked to the transmission of diseases by insect or snail vectors, such as schistosomiasis, malaria and filariasis, associated with water and potentially poorly managed aquaculture environments which may also require attention by public health officials and mitigation practices (40).
The incidence of zoonoses involving farm-raised species as vectors is relatively low. Foodborne illnesses are usually linked to the consumption of raw or undercooked products grown in sites contaminated by surface waters or watershed runoff. Most human illnesses are unreported because symptoms are often only mild gastroenteritis. Of all foodborne diseases in the United States of America (USA), only about 10% are attributed to seafood (or one illness per 250,000 servings) (50). Deaths and serious illness have occurred, but such incidents involve mostly immunocompromised or at-risk individuals who have consumed raw shellfish. Public health agencies are responsible for developing estimates of public health risk due to consumption of microbiologically or chemically contaminated aquatic food products. Public protection is only effective if field surveillance and tissue sampling programmes are integrated into public health risk assessments to determine levels of actual exposure.

Public education and policy issues of emerging food safety hazards must be based on sound, factual scientific evidence rather than misconstrued information. The responsibility for food safety is industry-wide, from producers and processors to distributors, retailers and the food service, and also includes consumers, who should be educated about proper sanitation, handling and preparation methods.

Hazard analysis and critical control point approaches

Increasing attention is now devoted to aquaculture product safety through government programmes, industry initiatives and the new international standards such as the 'Proposed draft code of hygienic practice for the products of aquaculture' prepared by the Codex Committee on Fish and Fishery Products (15). Hazard analysis and critical control point (HACCP) approaches to ensuring food safety are applicable to both production and processing facilities (26). Federal programmes in the USA have supported the development of aquaculture producer quality assurance programmes (QAP) as well as HACCP implementation manuals for major species processing sectors (34, 35). Potential safety risks can be evaluated on a 'per farm' basis through the implementation of HACCP protocols and the adoption of preventive control measures. The QAPs are designed to identify potential pre-harvest food safety problems. These programmes employ safeguards and record-keeping systems to monitor treatments of pests and disease management (32, 33, 44, 61). The use of HACCP models in producer QAPs which are linked to processor HACCP plans can increase the awareness of both producers and processors of potential food safety concerns (36). Critical control points (CCPs) can then be addressed through proper control and preventive measures, and verification that measures are being effective can be monitored on a pre-determined basis or as needed. In the USA, regulatory agencies have developed a publication to educate producers on the proper use of drugs, vaccines and pesticides in aquaculture (37). In addition, a public-private sector task force has been formed to address potential public health concerns regarding farmed fish, to encourage the development of QAPs, to seek additional high priority drug approvals and to prevent violative drug or pesticide residues (58). Another alliance co-ordinated a national HACCP training effort and developed a standardised seafood HACCP curriculum for regulators and private industry (48).

The post-harvest stage requires the adoption of proper good manufacturing practices (GMPs) and total quality assurance (TQA) to prevent public health risks. Abuse, such as poor personal hygiene and the use of insanitary utensils and equipment, may result in human illness. Perishable aquatic foods are ideal substrates for bacteria and special care is needed to avoid foodborne disease. The application of HACCP approaches to identify and address potential public safety risks in post-harvest operations applies to all fish and shellfish species, whether farm-raised or harvested from the wild. The quality of processor sanitation practices has a direct correlation with the microbiological quality and safety of aquatic food products.

Environmental chemical contaminants

Human illness as a result of environmental chemicals is commonly associated with long-term exposure only. Illnesses linked to a single exposure (meal) are rare. Potential aquaculture production sites can be evaluated to minimise environmental chemical contamination or to determine mitigation needs. Problems are usually site-specific and can be corrected or avoided. In the USA, public health advisories for fish consumption are limited to wild species or hatchery-produced species subsequently released into the wild.

Maximum residue limits (MRLs), action levels, guidance levels or tolerances in fish have not yet been established for many pesticides used world-wide. In the USA, any food found to contain a pesticide of unknown tolerance could be subject to enforcement action, even if the level of exposure poses no public health threat. Rapid, reliable residue detection test kits are few or lacking. Laboratories may not be properly equipped or personnel may not be adequately trained to conduct accurate analytical detection work. Developing countries may lack data on trace chemical contaminants in aquacultural products and public health risks may be high in certain circumstances or where contaminated fish is a staple in diets (53).
Pesticides used in aquaculture to control aquatic weeds or other pests should be approved for food fish and aquatic sites. Pesticide products should be used only according to label directions, and containers should be properly disposed of to prevent contamination of waters. In areas where agricultural crops are grown in close proximity to aquacultural ponds, an adequate buffer zone should be established to avoid potential drift from aerial spraying; alternatively, the use of careful manual methods of pesticide application are recommended. The past land-use history of a prospective production site should be investigated to avoid any heavily contaminated 'hot spots'.

Persistent organochlorine pesticides, such as aldrin, endrin, dieldrin, chlordane, toxaphene, chlordene, dichloro-diphenyltrichloroethane (DDT), dichlorodiphenyldichloro-ethylene (DDE), 1,1-dichloro-2,2-bis(p-chlorophenyl)ethane (DDD), heptachlor epoxide and mirex can pose safety risks for many years after use. Organic contaminants, specifically polychlorinated biphenyls and dioxins residues, can also cause potential problems. Residues in shellfish are not generally widespread problems but are rather localised in areas near waste or industrial sites (24). In some countries, however, there are incidences of widespread contamination of fishery stocks from persistent organochlorine compounds and associated public health risks (55). Urban and industrial areas can be point sources of environmental residues. Marine sites should be situated far from industries associated with environmental pollutants, such as paper and pulp mills.

There is a lack of scientific data correlating environmental trace contaminants (in sediments or water) with public health risks from the consumption of exposed aquacultural products. End-product testing dominates residue monitoring and enforcement programmes. The degree of chemical contamination is taken into consideration with regard to the classification of harvesting waters for molluscan shellfish (25). Unless there is an accidental spill or other chemical catastrophe, shellfish, as presently monitored for environmental contaminants in many countries, pose no public health concern according to analytical results which are typically below action levels.

Drug residues

Aquaculture, like other animal agriculture sectors, relies upon good management and proper use of drugs and chemicals to combat infectious disease pathogens. Disease outbreaks are costly and can be financially devastating. However, relatively few therapeutants are approved for use in aquatic species in many countries. Differences also exist between countries regarding which drugs are approved and how these can be legally accessed. In the USA, producers have direct access to federally approved 'over-the-counter' drugs, whereas in some other countries, drugs are only available on veterinary prescription (4, 5). Some countries have few or no regulations on the use of drugs or chemicals in aquaculture and guidance to producers on proper usage is sometimes lacking. The level of government intervention to control drug residues also varies considerably, from aggressive regulatory control to voluntary approaches. The Food and Drug Administration (FDA) of the USA routinely attempts to establish a priority for regulatory action based on human risk. Aquaculture drugs which have been classified for high priority regulatory action in the USA include chloramphenicol, nitrofurans, malachite green, fluorquinolones and quinolones.

Heavy metals

Trace metal bioaccumulation in aquatic foods poses a potential risk to humans. Health risks depend on long-term intake trends and individual conditions of health. Several metals are of toxicological significance to humans, including arsenic, cadmium, chromium, lead, copper, mercury, selenium, zinc and nickel. Proper site selection can avoid exposures to known sources of these contaminants. The chloralkali industry is a major source of mercury pollution (1). Heavy metals are rarely a problem with farm-raised fish because high-risk locations can be avoided. In addition, the residence time of aquaculture species in growing waters is limited to that between stocking and marketing, thus the period of exposure to environmental contaminants is reduced. Wild sources of aquatic foods generally carry a greater risk of trace metal bioaccumulation due to unmanageable, polluted surface waters or sediments and food chain concentration. There have been no confirmed reports of human illness resulting from trace metal levels found in seafood in the USA.

Production locations for molluscan bivalves and some crustaceans require special attention because the natural feeding behaviour of these species favours bioaccumulation of heavy metals and other contaminants in the environment (29). Heavy metals are concentrated more readily in organ tissue than in the body muscle of fish; in shrimp, heavy metals are concentrated mostly in organs, gills and the exoskeleton (51).
making full use of all available (published and unpublished) information and professional experience to ensure that the extra-label use does not result in the presence of unsafe drug residues in the edible tissues of food animals. However, drugs administered as a medicated feed are specifically exempted from the Act, and may not be used for any condition or use not defined on the approved product label. The impact of the Act on drug availability and drug residues in aquaculture is unknown at this time.

There is a scarcity of validated drug residue analytical detection methods and a lack of data for risk assessment and management for the multitude of drugs, diseases and animal species involved in aquaculture world-wide (11). The lack of international harmonisation or equivalencies in the regulation of aquaculture drugs can impede international trade. Food hygiene laws in one country may prohibit the importation of a product from another country where laws differ concerning tolerances and drugs approved for aquaculture. Uniform MRLs are generally lacking for aquaculture drugs, and there is an urgent need to adopt international harmonisation protocols for both drug registrations (approvals) and internationally recognised MRLs. The goal is to protect public health through the proper use of safe and efficacious therapeutics.

Concern is mounting regarding the widespread use of drugs, particularly human drugs, in aquaculture because of the potential for evolution of antimicrobial resistance in human pathogens caused by such use (19). Approaches to control this risk include elimination of the indiscriminate use of antimicrobials, restriction of drug use to those products for which there is adequate data to support efficacious treatment, supervision of the drug therapy under the control of veterinarians or specialised aquatic animal health providers, and development of education programmes to train unsupervised producers in proper drug use protocols and record-keeping systems. Integration of the use of drugs with other good management practices and vaccine use is the key to reduction of drug use and potential human risk from drug residues.

**Viral diseases**

Shellfish including oysters, mussels and clams are filter-feeding molluscs which can bioaccumulate human pathogens at levels higher than those in surrounding waters. Shellfish-borne enteric viral illnesses have resulted in human disease outbreaks world-wide. The consumption of contaminated shellfish has resulted in illnesses due to hepatitis A and Norwalk-like viruses. Protocols to rapidly extract and detect various viral pathogens from shellfish to allow further evaluation of the public health safety risks associated with shellfish consumption are being developed. Norwalk-like viruses reportedly pose the greatest public health threat associated with raw shellfish consumption. Outbreaks due to shellfish-borne Norwalk-like viruses which cause acute gastroenteritis have been reported throughout the USA from domestically harvested shellfish (39).

**Bacterial diseases**

Several bacteria can affect the health of both fish and humans. Public health risks from bacteria are usually low, but high incidences of illness can occur in certain circumstances. Other bacteria are of speculative concern to human safety. Some have been found in and on aquaculture products, but there are few reports of human illnesses. Any potential microbial safety risk can be significantly reduced by cooking, proper sanitation in processing, handling and storage.

Some bacteria are ubiquitous in aquatic environments and are present in the food supply at all stages of production, processing, preparation, handling and storage. In tropical climates, diverse enteric bacteria can be found in pond environments which necessitate the adoption of strict hygiene procedures during handling and processing to prevent the transfer of potentially pathogenic bacteria to humans (49). *Escherichia coli*, *Staphylococcus aureus* and *Salmonella* spp. have been isolated from pond waters, but any direct correlation between enteric bacterial loads in fish and adverse public health problems is speculative or unproven. Potential health risks are reduced when foods are hygienically handled and thoroughly cooked prior to consumption, even though the fish have been exposed to enteric bacteria during culture.

A bacterium recently linked to intensive recirculation tank systems in the USA is *Streptococcus iniae*. A virulent strain has been isolated in humans: this has infected several consumers who purchased live *Tilapia* sp. and presumably became infected through an open wound while cleaning the fish. Human infections may be demonstrated most frequently as cutaneous lesions, but systemic infections have also been reported (3). Careful handling to prevent puncture wounds and the use of gloves to avoid direct contact between fish and open cuts is the best preventive measure.

The naturally-occurring estuarine bacterium *Vibrio vulnificus* is one of the most severe foodborne infectious diseases associated with the consumption of raw or undercooked shellfish. This bacterium inhabits certain temperate and warm water regions. Evidence suggests that other human pathogenic vibrios can also be found naturally in brackish water culture environments, including *V. alginolyticus* and *V. parahaemolyticus* (6). In infected humans with weakened immune systems or in the elderly, mortality rates can range from 25% to 50% (45). *Vibrio* sp. bacteria can cause conjunctivitis, enteritis, diarrhea and abdominal pain in addition to death (8). Until recently, there has been no
effective means to eliminate the *Vibrio* spp. health hazard from oysters destined for raw consumption. Based on recent work, a commercial process using a short-term heat treatment has been effective in reducing *V. vulnificus* to undetectable levels (16). Labelling of this product has been approved by the FDA. Studies have shown that irradiation will also produce a product acceptable for the half shell market while reducing *Vibrio* sp. bacteria to undetectable levels, but the use of irradiation for this purpose has not been approved in the USA.

Other *Vibrio* spp., in particular *V. cholerae* serotype O1 (23), can cause human diseases. The results of a sampling survey which tested imported cultured shrimp for *V. cholerae* non-O1 concluded that such products may not constitute a public health hazard (18). Potential problems develop from poor sanitation and handling practices. *Cholera* is associated with the consumption of seafood contaminated with toxigenic *V. cholerae*: the management and control of human waste vectors are required to prevent outbreaks, although *V. cholerae* persists in estuarine areas as endogenous microflora.

Individual water quality certification programmes contend with faeces-related microbial contaminants and are critical for the monitoring of commercial shellfish-harvesting waters. Quality criteria have been developed to maintain safety conditions for products which are generally consumed raw (23, 31). There are approved and alternate indicators of growing water quality for shellfish (38), including human-specific faecal pollution. These indicators are critical to protect consumers from gastroenteritis and other microbial diseases associated with the consumption of shellfish (52). Many estuaries are increasingly threatened by contamination from discharges of wastewater effluents. Growing waters located adjacent to croplands or receiving runoff water from potential sources of contamination often have higher bacterial counts (14) and are more prone to closure of harvesting areas as a result of unsafe contamination levels. Domestic pollution can also contribute to contaminated shellfish growing waters.

Depuration (controlled purification) methods, including the use of ozone and ultraviolet light, have been developed to reduce faecal coliform accumulations in shellfish, but the practice used varies according to need, location and economics. *Vibrio* sp. bacteria are resistant to depuration and whilst the practice of relying shellfish to clean waters for depuration can reduce enteric bacteria and viruses, this practice is not effective for marine vibrios (28). Offshore suspension relaying of oysters has reduced levels of *V. vulnificus* because of exposure to high salinity water and an environment devoid of pathogenic *Vibrio* sp. bacteria (46).

There are other bacteria pathogenic to fish which can cause infections in humans, but the incidence is very low and symptoms are usually either localised wound infections or gastroenteritis. Such bacteria include *Aeromonas hydrophila* and *Edwardsiella tarda*. *Plesiomonas shigelloides* can be found in cultured fish and can cause food poisoning in humans when uncooked fish or shellfish are consumed. The majority of patients have serious pre-existing health problems (10, 59). Many bacterial illnesses are associated mostly with contaminated water or product handling. Other human pathogens have been isolated from aquaculture environments, however the numbers of pathogens detected on processed products are low and are not likely to cause disease except under highly unusual circumstances of improper handling, preparation or processing.

Human wastewater is used for fish rearing in some cases and, with proper treatment before reuse, can produce products suitable for consumption (22). Human faeces (night soil) are vectors for enteric bacteria and viruses and thus pose a potential public health risk. Night soil is used as a fertiliser in some countries, primarily in rural areas where manufactured inputs are expensive and/or scarce. Farm workers and consumers of raw products sourced from ponds exposed to untreated ‘night soil’ may experience high incidences of ascariasis, trichiasis, clonorchiasis, fasciolopsiasis, schistosomiasis, *Salmonella* and hepatitis B (42). Treating night soil in an anaerobic digester before application as a fertiliser can drastically reduce public health risks. Restricted use of wastewater can also decrease human illnesses, and guidelines exist for the safe use of wastewater in aquaculture (9, 43, 62). Naegel has written a comprehensive review on potential public health problems involving the integration of animal husbandry and aquaculture (47).

**Parasites**

Several parasites found in fish can infect humans as non-traditional hosts. The mode of entry into humans is by ingestion of raw or uncooked infected fish. Proper cooking or freezing prevents transmission of ingested human pathogenic parasites. Some parasites are found only in tropical regions. The prevalence and importance of parasitic infections vary markedly and depend on local risk factors and conditions.

Health hazards resulting from trematode parasites in cultured fish exist primarily in South-East Asia (41). According to World Health Organisation officials, foodborne trematode infections are a major public health problem and are endemic in twenty countries, affecting millions of people (A. Reilly, personal communication). However, the extent of the problem as associated directly with farm-raised fish is undetermined.

Anisakiasis, the human illness caused by members of the genera *Anisakis* or *Pseudoterranova*, is one of the few parasitic diseases acquired from marine fish. Anisakid larvae have not been found in pen-reared salmon which had been fed commercial feed, but are common in wild-caught salmon (2,
20). Another nematode of the genus *Eustrongyloides* has been acquired by persons consuming estuarine fish. Some other fish-borne parasites which can affect humans are the tapeworms *Diphyllobothrium* spp., *Dигrama brauni*, and *Ligula intestinalis* and the trematodes *Clonorchis sinensis*, *Opisthorchis* spp., *Heterophyes* spp., *Haplorchis* spp., *Metagonomus* spp. and *Diorchitrema* spp. (21). Crustaceans are vectors of trematodes of the genus *Paragonomus* spp. which mature in human lungs. Bivalve molluscs may be vectors for human protozoa such as *Giardia lamblia* or *Cryptosporidium parvum* (7).

**Marine biotoxins**

Captive fish and shellfish farmed in open waters are exposed to the same algal bloom toxins as their wild stock counterparts. Shellfish are likely to serve as vectors of any toxin or contaminant and public health concern will continue to have an impact on molluscan aquaculture development and product marketing (37). Shellfish poisonings occur world-wide and present difficult problems for public health management organisations. Potential risks can be reduced by understanding the natural phenomena of biotoxins, planning carefully for site selection and monitoring for known toxin-producing algae. Public awareness, coastal engineering and classification of waters also can help protect public health.

In fisheries and aquaculture, the risk of foodborne toxin originates primarily in marine waters. Cyanobacteria toxins associated with some blue-green algae are found in fresh water, but are rarely associated with illnesses. Human poisoning and death can result from the consumption of some biotoxins and a single event can incur immense economic losses (17). Paralytic shellfish poisoning, diarrhoeal shellfish poisoning, neurotoxic shellfish poisoning and amnesic shellfish poisoning are caused by the consumption of shellfish contaminated by the accumulation of biotoxins from various unicellular marine algae (12, 56). Seasonal episodes of toxic events can be particularly serious and can last for an extended period, resulting in many cases of illness (27). All filter-feeding molluscs are capable of accumulating toxin-producing algae. Public health risks range from severe illness to death, depending on the specific biotoxin and the situation.

Toxic aquatic foods can also result from bacterial action, such as scombroid poisoning (also known as histamine poisoning). Symptoms are similar to a food allergy and often subside within several days (60). Scombroid poisoning results from the consumption of some marine fish which have high histamine levels. Histamine levels become elevated due to bacterial degradation of the amino acid, histidine, in decomposed fish. Prevention involves proper temperature control of risk-associated marine species from harvest through to consumption.

Ciguatera poisoning is caused by the consumption of certain species of tropical and subtropical fish which eat toxic algae, and which can accumulate concentrations of the ciguatoxin. There is little evidence for this particular foodborne illness being transmitted through most marine aquaculture species, and the chance of occurrence in aquaculture is low. Cultured fish are generally fed commercially-prepared diets and are not part of the natural food chain involving the consumption of potentially toxic algae or other fish containing the ciguatoxin.

**Feeds and feed additives**

The mycotoxin aflatoxin B1 may occur in fish feed as a result of the use of contaminated grain ingredients. In channel catfish, there is a very low potential for accumulation of aflatoxin in edible tissues of this species from the consumption of contaminated feed (54), thus aflatoxin may not pose a significant residue problem in this species. Pesticide residues in raw agricultural commodities which are used as aquacultural feed ingredients may be transferred to aquaculture food products as secondary residues, and regulatory tolerance levels are often lacking for commercial aquacultural feedstuffs. Studies indicate that domoic acid (DA) probably does not accumulate in the edible tissue of aquaculture food fish which have been fed commercial feeds prepared with fish-meal sourced from fish containing the DA toxin (30).

**Conclusion**

Aquaculture is forecast to be an increasingly important source of food in both international trade and subsistence sectors. As with any food product, potential public health risks do exist, but most human safety hazards in aquaculture can be avoided by proper site selection, responsible production management and the use of monitoring and controls if needed. Human health risk data and information associated with environmental contaminants or drug and chemical residues are lacking. Numerous compounds which have not been approved are available; these may be used during production. However, few countries currently have the ability to initiate and maintain a surveillance programme which includes sampling and testing of both imported and domestic products for potential violative residues. The constraining factors include the lack of validated residue detection methods for specific compounds and aquatic species, and costs.

Any potential abuse or carelessness associated with the misuse of illegal compounds to manage diseases or pests should be avoided through the education and training of farmers. Rural, small-scale fish farmers, in particular, may need current information on the recommended treatments or materials which do not pose a health concern and on criteria for a suitable production site. In the USA, producer quality
Assurance programmes identify potential human safety hazards and provide guidance for prevention or controls if needed.

The highest public health risks are associated with uncooked or undercooked products and circumstances where aquatic species are cultured in open or natural water conditions. In natural environments, control measures or management is often constrained to prevent contamination from outside sources or exposure to naturally-occurring biotoxins. Man-made materials which can contain toxic substances may be soluble in water and can reach natural water bodies where aquatic foods may be cultured. One of the most severe known foodborne diseases in humans is linked directly to the consumption of raw or undercooked shellfish contaminated by naturally-occurring Vibrio sp. in the growing environment. Elderly persons or those with weakened immune systems can die from this pathogen. Most known public health risks involving aquaculture, other than possible disease from some waterborne insects or snail vectors, are associated with the consumption of raw products. Proper sanitation and thorough cooking are the best preventive actions which consumers can take to avoid potential illness.

The advent of the HACCP system, and the increasing international adoption of this system as a standard approach to prevent food safety hazards in all foods, will further assure the safety and wholesomeness of products destined for international markets. Pre-harvest HACCP-based implementation is still evolving with various options to identify actual site-specific safety hazards and the controls which may be adequate for monitoring and verifying the safety of farm-raised products which satisfy regulators, processors and consumers. Fortunately, aquaculture offers a more controlled form of aquatic food production which is less prone to common seafood-borne illnesses, but safety can be compromised by environmental contaminants and mishandling during processing, marketing or preparation.

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Questions de santé publique en aquaculture

G.L. Jensen & K.J. Greenlees

Résumé
Les auteurs étudient les questions de santé publique liées à la consommation de produits de l'aquaculture, en se basant sur de nombreux exemples connus aux États-Unis d'Amérique. Comme toute autre denrée alimentaire, ces produits présentent des risques pour la santé publique, qui sont essentiellement liés à la production en milieux aquatiques ouverts ou à la consommation de produits crus ou mal cuits. À la différence des pêcheries naturelles, les systèmes d'aquaculture fermés permettent de réduire au minimum les risques pour la santé publique, moyennant une évaluation correcte du site et de bonnes pratiques d'aquaculture. Une utilisation rationnelle des pesticides et des médicaments peut éviter la présence de résidus non autorisés et garantir l'innocuité et la salubrité des produits. La mise en œuvre d'une réglementation basée sur la méthode de l'analyse des risques, points critiques pour leur maîtrise, devra renforcer l'approche préventive du contrôle des risques. Le risque majeur pour la santé publique réside dans la production de coquillages dans des eaux de surface ouvertes, où des polluants naturels et des traces de résidus peuvent s'accumuler dans les tissus et provoquer des épidémies (dans certains cas graves, pouvant entraîner la mort). La mise en œuvre de programmes
de certificación de la calidad de la agua y de acciones de vigilancia y seguimiento, con pruebas, ensayos y seguimiento de los productos, puede garantizar el respeto de los principales criterios de seguridad. Los autores enfatizan el impacto de los riesgos de salud pública asociados a la producción; pero, no obstante, es necesario considerar la exposición de los consumidores a los riesgos derivados de la transformación de los productos de la acuicultura; en efecto, la manipulación y la preparación no conformes a los reglamentos de higiene o el almacenamiento a temperaturas inapropiadas pueden ser originarios de toxi-infecciones alimentarias (como en otros alimentos de origen animal).

Mots-clés

Planteamientos de salud pública en acuicultura
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Resumen
Partiendo de diversos ejemplos tomados de Estados Unidos de América, los autores examinan una serie de temas de salud pública relacionados con el consumo de productos acuícolas. Como ocurre con otras clases de alimentos, los productos acuícolas conllevan riesgos para la salud pública que vienen ligados básicamente a los medios acuáticos abiertos o a productos que se consumen crudos o insuficientemente cocinados. A diferencia de las pesquerías de aguas naturales, los sistemas acuícolas cerrados pueden minimizar los riesgos de salud pública gracias a una evaluación adecuada de su lugar de implantación y a la aplicación de buenas prácticas de acuicultura. Un uso racional de productos biológicos y productos terapéuticos puede prevenir la presencia de niveles ilícitos de residuos y garantizar así la inocuidad y seguridad del producto. La aplicación de los métodos de análisis de riesgos y control de puntos críticos consolidará la vocación preventiva de los sistemas de control de riesgos.

Los riesgos más peligrosos para la salud pública son los que resultan de la producción de marisco en aguas superficiales abiertas, donde los contaminantes de origen natural y los residuos de medicamentos pueden acumularse en los tejidos y causar brotes de enfermedad (que en los casos graves pueden desembocar en la muerte). Los programas de certificación de calidad del agua y la vigilancia de campo, que incluye el muestreo, análisis y seguimiento del producto, pueden satisfacer algunos criterios básicos de seguridad. Los autores se centran sobre todo en los riesgos de salud pública ligados a los procesos productivos. Sin embargo, hay que tener presente también la existencia de riesgos para el consumidor asociados al tratamiento de los productos acuícolas, así como la posible aparición de toxi-infecciones alimentarias favorecidas por la manipulación de alimentos en condiciones insalubres o su preparación y almacenamiento a temperaturas incorrectas (como sucede con otros productos alimentarios de origen animal).
Palabras clave

References


