

Scientific and moral considerations for live market practices

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Nociception, or the perception of painful stimuli, is often de-emphasized in lower or nonmammalian vertebrates (birds, reptiles, amphibians, and fish) because of the inability to easily recognize and assess pain in these species.¹ The failure to recognize pain in nonmammalian species does not belie its existence. A lack of mammalian-like responses to pain in nonmammalian vertebrates may mislead anthropocentric human observers.¹ For example, prey species have less overt pain-associated behaviors than do nonprey species; this survival mechanism diminishes signs of weakness that might attract the attention of predators.^{1,2} Fish may change color, posture, or water column usage in response to pain.³

Live Markets

Our ignorance of pain perception in nonmammalian vertebrate animals has colored societal attitudes. One example is, in the author's opinion, the *laissez-faire policy toward urban live markets in the United States*. These markets generally exist in large cities and provide access to fresh meat from fish, frogs, softshell and hardshell turtles, poultry, and other lower vertebrates. In the April 1 issue of the *JAVMA*, Dr. Howard Krum reported on an impressive veterinary intervention for hundreds of ill and traumatized turtles that were confiscated during shipment from Borneo and Sumatra to live markets in China.⁴ Live markets with similar fare and poor animal handling practices exist in the United States.

For most customers of urban live markets, fresh meat must be derived from an animal that is alive at the time of sale. In live markets in San Francisco, for example, actions committed in response to the demand for fresh meat include *heaping live frogs and turtles in small tanks* or mesh bags while awaiting sale; crowding of fish into inadequately oxygenated and unclean tanks; *penning chickens in undersized and unclean crates*; removing fish from water to elicit flopping responses that assure customers of the live and fresh status of their purchase; *cutting away shells from living hardshell turtles to access the head for killing*; *selling live chickens that are placed into paper or plastic bags for transport to the consumer's home*; and inadequate-

ly stunning fish that, without decapitation, remain mobile during descaling.⁵

The general public remains largely unobservant and uninvolved in these issues. The weekly news magazine *Time* recently quoted Michael Eisner, CEO of Disney, from his annual letter to shareholders in which he shares his apparent excitement about "live seafood and frogs for sale in the grocery section at the local Wal-Mart."³ Obviously, the editors may have intended an ironic emphasis when quoting Eisner, but what message does this implied enthusiasm for live markets, expressed by an entertainment industry magnate, send to our society?

Nociception and Analgesia in Lower Vertebrates

We can begin to increase our awareness of the inhumane treatment of lower vertebrate animals in live markets by understanding the nature of pain in these species. The study of nociception and analgesia, the latter defined as the amelioration or blocking of pain, in lower vertebrates has been rapidly expanding, mostly in the context of pet and zoo medicine.⁶⁻⁸ Until the early 1990s, the subject was largely overlooked by scientists and professionals, as evidenced by a lack of scientific articles on the subject of pain in birds, amphibians, reptiles, and fish.³ *Direct clinical experience and scientific research⁶⁻⁸ has led us to realize that these animals feel pain.*

The four processes of nociception are transduction, transmission, modulation, and perception. Transduction is conversion of the painful sensation to electrical activity at sensory nerve endings, or nociceptors. Transmission involves sending electrical impulses through the peripheral nervous system to the brain. Modulation converts the mode of transmission by release of natural chemicals or opioids (eg, endorphins or enkephalins) within the body. Perception of the painful sensation occurs only in the conscious animal.⁸ All of these nociceptive processes are active in nonmammalian vertebrates. Distinct nociceptors are demonstrable in amphibians.⁹ Substance P, a neuropeptide, is released at the site of a painful stimulus, and is conserved in nonmammalian vertebrates.³ Tachykinins are chemicals that are involved in pain transmission at the level of the spinal cord; these have been detected in frogs. The functional organization or distribution of tachykinins in the spinal cord of frogs is similar to that of mammals.¹⁰ Various opioid chemical substances that

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modulate pain are produced in the nervous system of lower vertebrates, as they are in mammals.¹¹ Opioid receptors have been identified in the spinal cord of frogs and other species, further substantiating the presence of endogenous pain modulation systems similar to mammals.^{12,13} A wide variety of nonopioid analgesics are effective in obviating the wiping response to acetic acid-induced pain in the skin of amphibians.¹⁴

How is pain perception recognized in lower vertebrates? The four basic mammalian responses to pain include startle reactions, flight or moving away from the source of the painful stimulus, vocalization, and coordinated reaction such as biting the source of pain or rubbing the painful area. These responses have been observed in nonmammalian vertebrates,³ although vocalization occurs primarily in birds. Other responses unique to lower vertebrates may be unpredictable from studies in mammals. For example, some birds may react to extreme or chronic pain by becoming immobile¹⁵; remaining still may have evolutionary advantages as it decreases attractiveness to predators.

Injury to tissue lowers the threshold for pain, a process that is termed hyperalgesia.⁸ Hyperalgesia may contribute to the suffering of live market frogs, turtles, birds, and fish that are subjected to pressure and scraping from crowding, rough handling, and inadequate hydration. The mucous layer of the skin is damaged easily in frogs and fish, increasing susceptibility to further injury, inflammation, and resultant pain.¹⁶ Injury from a light skin scraping increases the sensitivity of frog skin to tactile stimuli.⁶ In birds, damage to major feathers is painful.¹⁷ As a result of these injuries, sensitivity to pain can increase at sites throughout the body.⁸

Methods of analgesia in the context of killing or euthanasia have evolved as our understanding of pain perception in lower vertebrates has improved. It is now known, for example, that refrigeration of amphibians to the point of immobility prior to invasive procedures is not humane; immobile cold amphibians still feel pain.⁶ Endogenous opioid systems are down-regulated, and pain thresholds are decreased in frogs adapted to 4°C.¹⁸

According to the report¹⁹ by the 2000 American Veterinary Medical Association Panel on Euthanasia, any physical killing method that does not include previous or concurrent rendering of unconsciousness is unacceptable. This is because, as stated previously, perception of pain occurs only in conscious animals. Humane killing of lower vertebrates has special requirements, because the brains of these animals are tolerant to conditions of hypoxia and hypovolemia.²⁰ Thus, humane methods of killing would include decapitation followed immediately by pithing, or stunning followed by decapitation for reptiles, fish, and amphibians. Decapitation alone is not acceptable because these animals essentially remain conscious even after the head is severed. Spiking or percussive stunning results in immediate loss of visual-evoked responses in farmed Atlantic salmon; however, exsanguination or carbon dioxide narcosis followed by exsanguination results in prolonged visual-evoked responses of up to 9 minutes, as well as observation of aversive reactions by the fish.²¹ It may be impossible to humanely kill a hardshell turtle using physical meth-

ods alone, because the head cannot be painlessly extracted from the shell for stunning or pithing. In the author's opinion, decapitation alone is marginally humane in birds unless it is accompanied by another method to induce rapid loss of consciousness. Inhumane methods in birds also include exsanguination, or bleeding out, without prior sedation or stunning. Humane methods of killing lower vertebrates do not appear to be consistently practiced in the setting of live markets.

Current Improvements in the Meat and Fish Industry

It may be convenient to excuse live market practices because of a perception that humane practices are not used in the commercial meat and fish industry. In fact, many institutions are endeavoring to reduce animal suffering in the context of slaughter for food. The University of California at Davis Cooperative Extension, in conjunction with industry representatives, has prepared guidelines for humane handling and slaughter of various species of farm animals, including birds. The Department of Agriculture's Food Safety and Inspection Service (FSIS) is the agency that is responsible for ensuring compliance with the Humane Methods of Slaughter Act. A committee within FSIS, formed following results of a survey regarding humane handling procedures in slaughterhouses, is charged with establishing more definitive criteria for humane handling of animals. In February 2002, FSIS announced the appointment of 17 new district veterinary specialists who will be the primary contact in each FSIS district office for humane handling and slaughter issues, and who will conduct on-site verification of humane handling of food animals. These resources will further bolster supervision by FSIS of humane standards for killing.

The American Humane Association (AHA), the oldest national organization dedicated to child and animal protection, has recently developed the Free Farmed Certificate Program. This is a voluntary program that provides independent verification that the care and handling of livestock and poultry on enrolled farms meets the Animal Welfare Standards set forth by the AHA.^b In 1999, a survey conducted by the Animal Industry Foundation (presently, the Animal Agriculture Alliance) found that consumers want these humanely raised products and are willing to pay more for them.^b

In 1999, McDonald's Corporation began voluntary programs of auditing plants that provide them with beef. Improvements have been made steadily, particularly after one large plant was removed from the approved supplier list and others were suspended. Dr. Temple Grandin,¹ an expert in animal welfare and design of livestock handling facilities, has instituted many "best practice" procedures in an attempt to minimize animal stress in these facilities throughout the industry. In June 2002, the Food Marketing Institute and the National Council of Chain Restaurants launched the Food Industry Animal Welfare Program to improve food animal welfare practices^c; the AVMA is an active supporter and participant in this program.^d The Canadian and American poultry industries are

considering conveying birds into gas-filled chambers to render them unconscious prior to killing. Reduction in the allowable transit times from growing to processing facilities is being promoted; more attention is being paid to humane handling of hens that are considered spent (ie, those with egg production below a level that is economically advantageous) to ensure that all such birds are handled humanely in transit. The shipment of birds at night, when temperatures are cooler and birds are naturally quieter, is being encouraged.

Although most farmed fish in California are sold live, some facilities process fish humanely by chilling, followed by stunning and exsanguination. Methods are being investigated to standardize stunning of larger fish, including the use of captive bolt systems.^c According to Fred Conte, Extension Aquaculture Specialist of the Department of Animal Science, University of California at Davis, some of the practices in fish handling and processing in California are “ahead of the curve” because of the understanding by industry for the need to preserve the quality of the fish meat product.^c Fish are also affected more rapidly by adverse environmental changes than air-breathing animals; therefore, if stress is not avoided during rearing, handling, and processing, there may be rapid economic loss.²² At the same time, members of the industry who are examining welfare issues regarding handling and processing of fish must realize that there is a social trend to favor food industries that recognize those same concerns.^c

Legal Considerations for the Live Market

Improvement in practices within the commercial meat industry is necessary, and positive steps are apparently being taken. Can we say the same for the live markets? In a legal sense, the answer is affirmative at least in the state of California. In January 2001, the Kuehl law mandated “any person who operates a live animal market...shall provide that no animal (including frogs, turtles, and birds) will be dismembered, flayed, cut open, or have its skin, scales, feathers, or shell removed while the animal is still alive;” further, “no live animals will be confined, held, or displayed in such a manner that results, or is likely to result, in injury, starvation, dehydration, or suffocation.” There are also, somewhat surprisingly, other laws including section 579(b) of the California Penal Code that prohibit mutilation and cruel killing of animals, health and safety codes that prohibit keeping live animals where other food is sold, and fish and game codes that prohibit taking frogs and turtles from the wild for commercial purposes. Nevertheless, there has been little or no improvement in the plight of the animals sold in California live markets despite laws to protect them. Unlike the efforts of the scientific community and the meat production industry to improve animal welfare in the context of commercial large-scale food production, there is no similar organization that is willing or able to ensure compliance and enforcement of laws governing live market practices.

Conclusions

The manner in which a society treats animals reflects that society's attitude toward all life. What message does it send to our youth when we teach that pain

and cruelty inflicted on human beings is wrong and must be punished, but inhumane handling and slaughtering of fish, birds, frogs, and turtles in live markets is justifiable? As veterinarians, it is our duty to diminish pain and suffering in any animal that is under our care, or as stated in the Veterinarian's Oath, “to solemnly swear to use [our] scientific knowledge and skills for the benefit of society through the protection of animal health, the relief of animal suffering...” If we expand this duty logically, it should extend to any situation in which we perceive undue suffering. As veterinarians, we can and should lead the way to the more humane handling of all animals intended for food.

^aPersonal observations in San Francisco Stockton Street live market, 2001-2002.

^bFree Farmed. Available at: <http://www.freefarmed.org>. Accessed Mar 13, 2002.

^cFood Marketing Institute. Available at: http://www.fmi.org/animal_welfare/. Accessed Nov 12, 2002.

^dAVMA Public Information. Available at: http://www.avma.org/press/pifoodindustry_020315.asp. Accessed Nov 12, 2002.

^eConte FS, University of California Cooperative Extension Aquaculture Specialist, Department of Animal Science, University of California, Davis, Calif: Personal communication, 2002.

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