



REVIEW
ARTICLE

The role of veterinarians in quality meat production

■ CHANDRA SHEKHAR

AUTHOR FOR CORRESPONDENCE :

CHANDRA SHEKHAR

Department of Veterinary Public Health and Epidemiology, College of Veterinary Science and Animal Husbandry, N.D. University of Agriculture and Technology, Kumarganj, FAIZABAD (U.P.) INDIA
Email : cshekharyph@gmail.com

Abstract : Veterinarians in the world are closely involved with foods of animal origin. Veterinarians working in both government and in the private sector as well as veterinarians working in research facilitate the safe production of food. Veterinarians have key roles in all aspects of the control of food-borne hazards of animal origin. The traditional focus of veterinary involvement in food safety has been in meat hygiene at the level of the slaughterhouse. The education and training of veterinarians, which includes both animal health (including zoonoses) and food hygiene components, makes them uniquely equipped to play a central role in ensuring food safety, especially the safety of foods of animal origin. Veterinarians play a key role in ensuring that animals are kept under hygienic conditions and in the early detection, surveillance and treatment of animal diseases, including conditions of public health significance. Veterinarians also provide livestock producers with information, advice and training on how to avoid, eliminate or control food safety hazards (e.g., drug and pesticide residues, mycotoxins and environmental contaminants) in primary production, including through animal feed. Veterinarians have the knowledge and expertise to audit the standards of animal health, animal welfare and public health from “stable to table”.

Key words : Veterinarians, Antemortem inspection, Postmortem inspection, Food safety

How to cite this paper : Shekhar, Chandra (2016). The role of veterinarians in quality meat production. *Vet. Sci. Res. J.*, 7(2) : 122-128, DOI : **10.15740/HAS/VSRJ/7.2/122-128**.

Paper History : Received : 26.08.2016; Accepted : 24.09.2016

INTRODUCTION

The role of veterinarians has traditionally extended from the farm to the slaughterhouse, where veterinarians have a dual responsibility that is epidemiological surveillance of animal diseases and ensuring the safety and suitability of meat (OIE, 2007). In many countries the role of the veterinary services has been extended to include subsequent stages of the food chain in the “farm to fork” continuum (OIE, 2010). Food hygiene problems have changed in recent years not only as a result of new methods of animal production, but also because of changes in food processing technology and in the presentation of food to the consumer, increased environmental pollution, increased international trade, and increased tourist travel. Food safety and quality are best assured by an integrated, multidisciplinary approach, considering the whole of the food chain. Eliminating or controlling food hazards at source, *i.e.* a preventive approach, is more effective in reducing or eliminating the risk of unwanted health effects than relying on control of the final

product, traditionally applied via a final ‘quality check’ approach. Approaches to food safety have evolved in recent decades, from traditional controls based on good practices (Good Agricultural Practice, Good Hygienic Practice, etc.), via more targeted food safety systems based on hazard analysis and critical control points (HACCP) to risk-based approaches using food safety risk analysis (McKenzie and Hathaway, 2006). Traditional meat inspection procedures are complex and resource-intensive and so a number of recent studies have used a risk assessment approach to determine their relative value in minimising meat-borne risks (Hathaway, 2004).

Activities and responsibilities of veterinarians in quality meat production :

Veterinary involvement in food safety activities throughout the food chain may encompass food safety, zoonoses and animal health. Risk management activities in these areas contribute in various ways to reducing food-borne risks to human health by preventing, eliminating or controlling hazards transmitted by food (WHO, 2002). Veterinarians play a central role in ensuring the responsible and prudent use of biological products and veterinary drugs, including antimicrobials in animal husbandry. This helps to minimise the risk of developing antimicrobial resistance and unsafe levels of veterinary drug residues in foods of animal origin (OIE, 2007). Therefore, veterinarians play their important roles in quality meat production through their following activities and responsibilities-

Animal farm inspection:

Veterinarians visit the animal farm for the following objectives :

Ensuring the animal welfare:

Veterinarians play a very important role in maintaining the animal welfare on the farms. Within the United Kingdom, Codes of recommendations for the welfare of livestock has been produced under the provision of the Agriculture (Miscellaneous Provisions) Act 1968 in Great Britain, and the Welfare of the Animals (Northern Ireland) Act 1972 for Northern Ireland. There are now codes available for cattle, sheep, pig deer, poultry, turkey and ducks and these are designed to encourage good stockmanship, particularly in young and inexperienced workers. All the codes are based on the five ‘freedoms’ or basic animal needs as follows :

- Freedom from thirst, hunger and malnutrition.
- Freedom from fear and distress.
- Freedom to display most normal patterns of behaviour.
- Appropriate comfort and shelter.
- Rapid diagnosis and prevention.

It is often said that good animal welfare equates to good food safety. Public health, animal health and animal welfare are indeed interrelated and require a holistic approach (Federation of Veterinarians of Europe, 2011). As an example of this, stressed animals are more likely to develop diseases, which will require veterinary treatment.

Ensuring the correct use of medicine:

Veterinarians have role to visit the farms and guide the farmers in use of medicines for any animals that get sick. They want to make sure about the use of right medicine for the right species and the correct dose. Furthermore, they advise the farmers to ensure the records of what drugs are used on the farm and which individual animals receive these drugs. One of the most important reasons for this is to ensure that any animal, which is sent to slaughter, has drug residues below the permitted limit before it is slaughtered. This period is known as the “withdrawal period”. Withdrawal periods are typically around two to three weeks. However, for some drugs the withdrawal period can be as short as 12 hours and for others as long as many months. Veterinarians also assist and advise the farmer in the use of antibiotics because of the risk of developing resistance to antibiotics. It is also possible, in certain circumstances that these resistant bacteria could reach a slaughterhouse or a market, causing meat to become contaminated, which in turn may cause antibiotic resistance to be transferred to the consumers of such products.

Ensuring the good quality of animal feed:

Veterinarians have also a role in the inspection of animal feed. This is because, if the animal feed is incorrect or

toxic, it will affect the health of the animals, and in some cases, the toxin in the animal feed can be absorbed by the animal and then passed on to the consumer in the meat produced. Dioxins, heavy metals such as lead and mercury, polychlorinated biphenyls (PCBs), dichloro-diphenyl-trichloroethane (DDT), adionuclides, *Salmonella* spp. and the prion causing bovine spongiform encephalopathy (BSE) are well known examples of contamination in animal feed.

Animal inspection before transportation:

Animals must be examined by veterinarians before transportation of animals to a slaughterhouse for ensuring animal welfare as well as quality meat production. Animal health status must be kept in mind before their transportation. Animals suffering from disease, distress or injury are not recommended for transportation. Therefore, they must be free from these conditions to ensure the animal welfare and also to prevent economic losses that may incur in the form of mortality in the animals. Loading and unloading are most stressful part of the transport process. Therefore, animal welfare must be ensured during this process. There should be facility of proper ramp for loading of animals. Overloading of the animals in the vehicle must be avoided to prevent stress and mortality in the animals. The journey should be in a careful manner, avoid sudden stops and starts, fast cornering and unnecessary delays. Drinking water should also be provided to the animals during transport.

Zoonotic disease diagnosis:

Veterinarians are trained to recognize disease. Diseases of great interest to them are zoonoses which are diseases that can affect both animals and humans (Bousfield and Brown, 2011). Veterinarians play important role in the diagnosis and control of outbreaks of zoonoses. Moreover, veterinarian ensures that the disease does not enter the food chain.

Foodborne disease outbreak investigation:

Most reported outbreaks of foodborne disease are due to contamination of foods with zoonotic agents, often during primary production. Veterinarians play a key role in the investigation of such outbreaks all the way back to the farm and in formulating and implementing remedial measures once the source of the outbreak has been identified.

Antemortem inspection:

Professional examination of the live animal by a qualified veterinarian before slaughter is known as antemortem inspection. The principle of antemortem inspection is to determine the animal is normal or not. The veterinarians observe the conditions such as general behaviour of the animals, their level of nutrition, cleanliness of the animals and obvious sign of disease and other abnormalities during antemortem inspection in order to provide quality meat to the consumers. Both sides of an animal should be examined at rest and in motion. Antemortem examination should be done within 24 hours of slaughter and repeated if slaughter has been delayed over a day. Hogs and animals affected with extensive bruising or fractures require emergency slaughter. Animals showing clinical signs of disease should be held for veterinary examination and judgement. They are treated as “suspects” and should be segregated from the healthy animals (FAO, 1986). Antemortem inspection should ensure that animals whose meat may be fit for human consumption but that require special handling during slaughter and dressing, and animals that will require special attention during post-mortem inspection, are segregated and so handled or inspected (CAC, 1993). Antemortem and postmortem inspection includes “any procedure or test conducted by a competent person for the purpose of judgment of safety and suitability and disposition” (FAO, 2005). Antemortem and postmortem meat inspection programmes are primary responsibilities of national veterinary services (OIE, 2003). The veterinarians conduct antemortem inspection of animals with the following objectives-

- To ensure the protection of consumers from meat-borne diseases.
- To ensure the selection of normal and rested animals for quality meat production.
- To ensure the collection of reliable clinical information in order to conduct efficient postmortem examination.
- To provide clean, wholesome and disease free meat to the consumers.
- To prevent contamination of equipment, premises and personnel by animals suffering from communicable

diseases.

- To separate the animals suffering from rabies, tetanus etc. which are usually undetectable on routine postmortem examination.
- To assist in establishing and promoting the meat export trade by ensuring export of clean and wholesome meat.
- To enforce the application of humane method of slaughter.

Postmortem inspection:

The inspection of carcase and its visceral organs by a veterinarian is known as postmortem inspection. The main purpose of postmortem inspection is to detect and eliminate abnormalities including contamination to ensure wholesomeness of meat for human consumption. Many of the diseases and conditions rendering carcase unfit at postmortem, are not detectable at the time of antemortem inspection. Routine postmortem examination of a carcass should be carried out as soon as possible after the completion of dressing in order to detect any abnormalities so that products only conditionally fit for human consumption are not passed as food. All organs and carcase portions should be kept together and correlated for inspection before they are removed from the slaughter floor. Postmortem inspection should provide necessary information for the scientific evaluation of pathological lesions pertinent to the wholesomeness of meat (FAO, 1986). Localized lesions could be disposed by an inspector; however the final judgment of the carcass should be done by a veterinarian. A veterinarian follows the following principles of postmortem inspection to ensure the quality meat production-

- There should be sufficient time and adequate light facility for inspection of slaughter.
- A systematic procedure of inspection must be followed for all carcasses.
- Animal should be slaughtered in the presence of veterinarian.
- Lymph nodes associated with the organs must be examined carefully.

A veterinarian conduct the postmortem inspection with the following objectives :

- To protect the consumers against meat borne infections, intoxication and hazard associated with meat residues.
- To protect the consumers and meat industries against economic losses.
- To protect the meat handlers against occupational zoonotic diseases.
- To protect the livestock and consumers from spread of zoonotic diseases.

Physical examination of meat:

Veterinarian ensures quality meat production by physical examination of meat includes colour of meat in different food animals, abnormal colour and distribution of fat in the meat/carcass etc.

Chemical examination of meat:

Chemical examination of meat is required in certain circumstances to ensure the quality of meat. A veterinarian ensures the quality of meat by using different chemical tests that determine the glycogen content in muscle and liver, linolic acid in fat and iodine value of fat.

Microbiological examination of meat:

Microbiological examination of meat is very important from its shelf-life as well as public health point of view. Veterinarians play an important role in quality meat production by ensuring efficient microbiological examination of meat so that the meat produced is within the permissible limit of micro-organisms that is safe for consumers and suitable for further processing to manufacture the meat products. Veterinarians also ensure the quality meat production by implementing strict hygienic measures during all the stages of meat production.

Antimicrobial and drug residues examination of meat:

Antimicrobials and drug residues cause health hazards in consumers. Traditional meat inspection procedures have now had modern additional checks added in order to safeguard the public. These checks are to look for substances such as growth promoters, hormones, antibiotics or chemicals used legally or illegally in the production of the meat;

with the aim of significantly reducing the risk of the public consuming meat with harmful chemicals. Veterinarians should be involved in establishing drug withdrawal times. These should become an indispensable part of the codes on antemortem and postmortem inspection and judgement of slaughter animals. Such knowledge allows carcass disposal to be based on the expected excretion pattern. Studies of mode and duration of action, as well as of accelerated elimination of chemical substances from animals, should become an important part of research on every proposed drug (Matyas, 1978).

Ensuring the food safety:

Veterinarians are well equipped to assume important roles in ensuring food safety in other parts of the food chain, for example through the application of HACCP based controls and other quality assurance systems during food processing and distribution. The most veterinary involvement is currently focused on meat hygiene (McKenzie and Hathaway, 2003 and CAC, 2005). Quality assurance systems can be extended in the case of antemortem and postmortem inspection to “co-regulatory” systems that integrate industry and veterinary service activities (Butler *et al.*, 2003).

Veterinarians also play an important role in raising the awareness of food producers, processors and other stakeholders of the measures required to assure food safety. Standards concerned with food safety should be implemented within a generic framework for managing food-borne risks and should “recognize the need for flexibility consistent with the protection of consumers’ health” (FAO, 1999). Good hygienic practice (GHP) throughout the food chain is a prerequisite to a risk-based approach to food safety. Regulatory GHP requirements generally apply during primary and secondary processing, are prescriptive, and describe process requirements rather than outcomes. Veterinarians play their important role in ensuring food safety at different levels-

- *Ensuring the food safety at the market level:* Food animal markets, worldwide, are well known for spreading disease from farm back to farm or further down the “farm to fork” food chain. Therefore this is an area where additional measures are sometimes required such as “rest days” during which markets are kept empty while they are thoroughly cleansed. In some countries veterinarians routinely inspect live food animal markets for signs of ill health, contamination and poor welfare. Moreover, veterinary meat inspectors travel from slaughterhouse to slaughterhouse, making sure the meat sold in this country is safe to eat (OIE, 2016).

- *Ensuring the food safety at the slaughterhouse level:* Control and/or reduction of biological hazards of animal and public health importance by antemortem and postmortem meat inspection are a core responsibility of veterinary services (OIE, 2007). In most developed countries antemortem and postmortem meat inspection at the slaughterhouse is carried out (or audited) by veterinarians; as they are regarded as the most, competent and qualified persons to do such inspections (or audits). The United States Department of Agriculture (USDA) requires that a veterinarian be on site at a slaughterhouse at all working times and that personnel handling, herding, stunning, moving and transportation. A high general level of hygiene in a slaughterhouse is vital. It is, for example, important to make sure that there is no contamination (particularly of bacterial origin) between ‘unclean’ parts of a carcass such as stomach contents and the meat, which people will consume.

- *Ensuring the food safety during processing:* Veterinary involvement in food processing is seen mainly in the inspection of food factories, particularly in Europe, Australia and New Zealand, which export large quantities of meat, milk, cheese and yoghurt abroad.

- *Ensuring the food safety during storage and transport of food:* Veterinarians have a great interest in how foods of animal origin are stored prior to going to retailers. This is an area where, if one is not careful, mistakes can occur. In this respect, it is important that batches of food are kept separate from each other and are clearly marked and identified with their movements recorded. Certain countries use veterinary supervised inspections of the storage and transport of food.

- *Ensuring the food safety during sale of animal products:* Traditionally food retail and the correct handling and cooking of food in the kitchen at restaurants and at home were, in many countries, the responsibility of food inspectors and/or food hygienist and their related bodies. However, in Europe, particularly in France and Germany, veterinarians in the nineteenth and twentieth century were integral to the development of food hygiene laws, initially

to curb large outbreaks of trichinosis (Zylberman, 2011). The importance of food handling is also highlighted by the fact that the USDA estimates that 85 per cent of food poisoning cases could be avoided if people just handled food properly (Schafer and Driessen, 2011). As a result of this, the Centers for Disease Control and Prevention (CDC) in the USA, employs veterinary epidemiologists as part of the team to track down and investigate food poisoning cases.

Ensuring food suitability:

Suitability is regarded as the assurance that food is acceptable for human consumption according to its intended use. It is clear that in the case of meat hygiene, a major component of suitability is related to detection and removal of abnormalities in meat that are not of public health significance. Other aspects of suitability relating to consumer expectations include certification requirements such as the Codex general guidelines for use of the term 'Halal' (CAC, 1997).

Prevention of adulteration:

Veterinarians play a very important role in the prevention of adulteration of meat. Adulteration of meat may be defined as "the fraudulent practice which involves substitution or mixing of flesh of cheaper variety which is objectionable for the reasons of health, religion and economy". This act of cheating is punishable in India under the PFA Act, 1973. The substitution generally practiced are mutton for goat meat, beef for buffalo meat, rabbit meat for chicken, dog/cat meat or veal for goat meat, beef for horse flesh (in UK) and beef for Kangaroo (in Australia).

Certification of animal products for international trade:

Certification in relation to animal diseases, including zoonoses, and meat hygiene should be the responsibility of the veterinary authority (OIE, 2002). International veterinary health certificates underpin international trade and provide assurances to the importing country regarding the health status of the animals and products imported. International health certificates providing official assurances for trading of meat must engender full confidence to the country of importation (CAC, 1995). Veterinarians play an important role in providing health certification to international trading partners attesting that exported products meet both animal health and food safety standards. If food is to move across international borders, it often requires some form of veterinary health certification. Part of the certification ensures not only that the food is correctly handled at the correct temperature, but that it is also of good hygienic quality and safe to consume.

Conclusion and recommendations:

The world trade in agricultural products has increased many folds and the number of agents causing food-borne diseases is likewise increasing. In these situations, both government and private companies require new mixes of professions and technologists to help them overcome these challenges. Veterinarians are one of those professions to be intimately involved in facing these challenges. Due to globalization, more processed food, more and more food imports and exports worldwide, greater movement of animal and humans, it is expected that the turn of the veterinary profession to be one of the most crucial to society. In the fight against foodborne zoonoses, efficient surveillance systems, and risk assessment and management systems should be established. Moreover, constructive dialogue and collaboration between public health workers, veterinarians and food-safety experts is essential to develop effective prevention and control strategies.

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