

EPIDEMIOLOGY AND QUALITY ASSURANCE : APPLICATION TO FOOD SAFETY

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Au cours des dernières années, il y a eu une demande croissante pour des produits alimentaires d'origine animale répondant à des critères de qualité et de sécurité se rapportant à la santé humaine. En conséquence, le rôle des éleveurs et des vétérinaires praticiens va très probablement changer pour répondre à ces exigences. Aujourd'hui essentiellement tournée vers le soin individuel des animaux et la mise en oeuvre de programmes de santé de troupeaux, la profession vétérinaire devrait saisir l'opportunité de s'impliquer activement dans le développement de programmes d'assurance qualité au niveau des élevages visant à la réduction des agents pathogènes majeurs pour la santé humaine et des résidus. L'application des principes du HACCP (Hazard Analysis Critical Control Point) à tous les niveaux de la chaîne de production, de l'élevage à l'assiette du consommateur, est reconnu au niveau international pour la production de produits alimentaires sains dans le cadre de programme d'assurance qualité. Cet article insiste sur le rôle prépondérant que devrait jouer la profession vétérinaire dans ce développement, ainsi que les méthodes épidémiologiques appropriées pour mener à bien cette tâche.

INTRODUCTION

The liberalization of the global trade, and the fact that consumers are nowadays more and more demanding food to be not only economical, but also healthy, tasty, safe and sound in respect to animal welfare and the environment, are changing the so far quantity-oriented food production, guaranteeing the nutrient supply of populations, into a quality-oriented food market, where commodities, production areas, production chains and brands compete each other. In general, quality-oriented markets are customer-driven, which results in a "quality dictate" from the consumer through retail, wholesale, slaughter and processing "back" to the farmer, which is the reason for the growing influence of the consumer on animal production and its allied industry, as well as on advisers and consultants such as food animal veterinarians.

Consequently, the role of the food animal producer is changing from just raising animals to being an indispensable part of the food production chain that supplies a product that is the basis for the production of a wholesome, safe and high quality food product. Likewise, the veterinarian's former focusing at treating diseased animals, then at herd health and productivity will change to focusing at supporting the food animal producer to provide slaughter animals with quality properties that meet the demands of slaughterhouse and processors, wholesalers, retailers and finally the consumer. Apart from a consistent herd health management, the food animal practitioner will more and more be involved in on-farm pathogen control and on-farm residue prevention programs, monitoring systems and verification procedures.

This development demands the animal food veterinarian to extend the veterinary service from therapy of disease and disease control to the quality of the product of their clients, with the safety of the food produced from the animals being the main veterinary task.

QUALITY ASSURANCE

Quality is a very general term and there are many different definitions mainly depending on the sphere of life, in which it is used. For the use of the term in the field of production, sale and trade, it could be defined as: "...anything that enhances a product from the viewpoint of the customer".

Industries with long experiences in growing competition initially used quality control to cope with increasing quality standards. The needs to produce and sell high quality products and increase the efficiency of the production process, however, has led to the development of quality assurance systems along production chains. The difference between quality control and quality assurance can be explained as follows :

Quality control is the evaluation of a final product prior to its marketing, i.e. it is based on quality checks at the end of a production chain aiming at assigning the final product to quality categories such as "high quality", "regular quality", "low quality" and "non-marketable". Since, at the end of the production chain, there is no way to correct production failures or upgrade the quality of the final product, the low-quality products can only be sold at lower prices and the non-marketable products have to be discarded. Their production costs, however, had been as high as

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those of the high and regular quality products. Thus, quality control has only a limited potential to increase the quality and efficiency of a multi-step production procedure.

Quality Assurance, in contrast to quality control, is the implementation of quality checks at every production step, and of procedures to immediately correct any failure and mistake that is able to reduce the quality of the interim products guaranteeing a high quality of the final products.

Examples for quality control versus quality assurance in the area of food safety are: the testing of carcasses for residues is quality control, the implementation of residue avoiding production procedures at farm level is quality assurance; the testing of meat products for salmonella prior to their marketing and consumption is quality control, the implementation of salmonella-reducing and -eliminating measures as routine standard procedures at farm level is quality assurance.

In food production, where the safety of the produced food has the ultimate priority in the framework of quality, the Hazard Analysis Critical Control Point (HACCP) system is the internationally recognized system to help assure safe food production. HACCP emphasizes prevention in the avoidance of food safety problems. HACCP combines common sense with an evaluation of risks, to identify the points along the food production chain where possible hazards may occur, and then to strictly manage and monitor these points to make sure the process is in control.

It is common sense and obvious that any quality assurance system based on the HACCP system is most successful in keeping food safe when it is used throughout the entire food production chain from farm to table.

PRE-HARVEST FOOD SAFETY

To evaluate the present state of the realization of the farm-to-table concept, it is helpful to divide the production chain for food of animal origin into the pre-harvest (from breeding and raising the animals to supplying them to the slaughterhouse), the harvest (from stunning the animals to cutting the carcasses) and the post-harvest section (from processing, distributing, storing, selling and consuming the food).

There are five major reasons for the need of pre-harvest food safety measures to be added to the mandatory meat inspection and the classical post-harvest food hygiene :

1. The consumer's confidence in the safety of food is decreasing.
2. Modern agriculture is contributing to the increase of drug-resistant pathogens in humans and, thus, often attacked by the medical society.
3. Food safety issues are increasingly used as marketing tools and/or as non-tariff trade barriers.
4. The consumer has the tendency to ask more for fresh and naturally raised products without pathogen-reducing pre-consumption processing.
5. The traditional mandatory meat inspection still is indispensable, but unable to control and prevent the emerging foodborne pathogens of nowadays, since they do cause neither clinical disease in the herd nor lesions in the carcass.

The majority of the real and perceived reasons for the increased concerns with the safety and quality of meat apply to the pre-harvest area of the food production chain. Thus, the traditional mandatory meat inspection and the classical post-harvest food safety measures have a limited potential for major improvements of the safety and quality of meat. Therefore: Pre-harvest food safety programmes implementing the HACCP concept at farm level from breeding to the slaughterhouse gate have to be added to the existing harvest and post-harvest HACCP programs.

The implementation of information feedback systems along the food production chain are needed to have the management tool at hand that combines data from the slaughter plant (disease-related lesions, slaughter deficiencies, and monitoring results) with data on animal health and contaminations with food-borne pathogens and/or residues (diseases, pathogens, drug use) and the performance of the herds of origin.

The targets for intervention measures in the pork chain should be prioritized as follows:

1. On- and off-farm residue avoidance programs with consistent record keeping, proper drug use, storage and extended withdrawal times, and an overall reduction of antimicrobial substances used in agriculture both for medical and production purposes is necessary
2. On- and off-farm programs to develop trichinella-and toxoplasma-free herds, regions, areas and countries with a well-coordinated cooperation between packers, producers, veterinary officers and practitioners, and epidemiologists.
3. On-farm salmonella reduction programs with a statistically justified monitoring of the salmonella load of the animals supplied for slaughter.

4. On-farm programs to reduce *Yersinia enterocolitica*, *Campylobacter jejuni* and *Listeria monocytogenes*. However, more research on the prevalence of these pathogens in swine herds and on the feasibility of pre-harvest control measures is needed.

To reliably decrease the food-borne health risks and to improve the consumer's confidence in food of animal origin, pre-harvest food safety programs should consist of three elements:

1. Implementation of GMP's and HACCP programs aiming at reducing food-borne risks to human health at farm level.
2. Implementation of monitoring and surveillance programs at slaughter to determine the frequency of the introduction of food-borne health risks into the food chain identifying the farms of origin and mechanisms to develop incentives for the farming community to reduce these risks. This element is, as a rule, the "trigger" and "modulator" of any pre-harvest food safety program.
3. Implementation of a certification procedure involving independent agencies and persons such as accredited veterinarians and quality consultants.

EPIDEMIOLOGY FOR QUALITY ASSURANCE AND FOOD SAFETY

The epidemiological tools needed for the quality assurance approach to food safety (GMP, HACCP and certification) throughout the entire food chain are:

1. Quantification of health, disease, risk factors and infection in populations and of contamination and predisposing factors in environments,
2. Record keeping, data collection, data processing and data interpretation,
3. Sample strategies for monitoring and surveillance programs (representativeness, clustering, stratification, bias and confounding),
4. Evaluation of diagnostic tests (accuracy, preciseness, sensitivity and specificity),
5. Risk assessment, management and communication, and
6. Outbreak investigation (tracing back and forth, epidemiological teams and task forces, national and international reporting systems).

Producing animals for the production of high quality and certifiedly safe food products will make the clients of the veterinary profession a competitive, publicly accepted and appreciated component of the food production chain. The food animal practitioner making use of the above mentioned epidemiological knowledge will be an indispensable adviser and verifier that supports "his" clients' group to be always one step ahead, by which it will not only "stay in business", but even gain and maintain market leadership.

The described development may seem to be futuristic. However, there are already several efforts under way to actively implement pre-harvest quality assurance systems at farm level to complement harvest and post-harvest HACCP programs. Such efforts are the U.S.-American Pork Quality Assurance program run by the National Pork Producers Council, the Danish vertical quality assurance system with the recently implemented salmonella reduction program and the successful Dutch quality assurance program IKB (= Integrale Keten Beheersing), which has a strong influence on the Dutch food animal production.

The impact of the quality assurance approach from farm to table and the pre-harvest food safety concept on the food animal producing farmer and his consulting veterinarian to meet the quality and safety demands by implementing permanent on-farm quality assurance measures are described in the following paper *Epidemiology and Quality Assurance - Application at the Farm Level* by J. Noordhuizen and K. Frankena.