

ANIMAL HYGIENE AS A BASIS FOR PUBLIC HEALTH

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Abstract

Zoonoses are an important risk for public health. Salmonellosis is the most important food borne infection in the European Union. *Campylobacter*, EHEC, *Listeria monocytogenes*, *Cryptosporidium*, *Echinococcus granulosus* and *Trichinella spiralis* are zoonoses having the next highest priorities. In Finland, a special national salmonella control program has been carried on since 1995. The original objective of the control program, to maintain the national prevalence of all the serotypes of salmonella below 1% and the prevalence at individual abattoirs or cutting plants below 5%, has been reached and improved on in all branches of animal production. The cost-benefit ratio of the program was 19.8 for egg production and 5.4 or higher for meat production.

To protect our citizens from zoonoses and food borne diseases, we need many measures of varying types. Legislation, also on the international level, continuous control program including regular sampling on all the steps of the 'stable to table' chain, and good follow up and socioeconomic analyses of results are needed. The basis to all this is good hygienic measures on farms. Knowledge of animal hygiene is the cornerstone of this work.

INTRODUCTION

The European Council met in Helsinki on December 1999. Among the decisions made, the Council recalled the need to "ensure a high level of human health protection" in the definition of all Union policies. Particular attention must be given, according to the European Council, "to ensuring healthy and high quality food for all citizens by improving quality standards and enhancing control systems covering whole of the food chain" ("stable to table"). This statement was stimulated by the recent news of a dioxin crisis in Belgium, and other food scandals. But does this relate to animal hygiene, which deals with the "other end" of the chain, far away from the human consumer? Yes, certainly. We animal hygienists are very important players in "ensuring a high level of human health protection", especially because we work in the beginning of the "stable to table" chain (Saloniemi 1997).

The main effects of animal hygiene in public health are directed against zoonoses, contamination of food by heavy metals, pesticides etc., and antibiotic resistance of pathogen bacteria. I will discuss in this paper some aspects of zoonoses and animal hygiene.

ZOONOSES

Diarrhea, fever, headaches, and vomiting are very familiar symptoms for the more than 160 000 people annually who are infected with salmonellosis in the EU. Salmonellosis is the most reported zoonosis in Europe. The annual costs of food-borne salmonellosis are estimated at up to 2,8 billion euros per year. *Campylobacter* is the second most common zoonotic agent, and was reported in more than 120 000 cases of food borne illness in the EU in 1999. Verotoxigenic

Escherichia coli, *Listeria monocytogenes*, *Cryptosporidium*, *Echinococcus granulosus* and *Trichinella spiralis* are the other zoonoses having the highest priorities within EU.

The data available is not very comprehensive, but it indicates an increase in reported food-borne zoonotic diseases over the last twenty years. In Finland, the socioeconomic costs in prevention of food borne illnesses are now being studied. Preliminary results show that, for example in egg production from farms to retail business, preventive expenses are valued at about 5 eurocents per kilo (Kilpeläinen, S. *personal communication*). On farms, this includes routine sampling and analyzing of eggs and feeds in accordance with our salmonella prevention program, as well as the costs of recommended cleaning and disinfections procedures. On the national level, total prevention costs in the stable to table chain are less than the approximated socioeconomic cost of one human death.

SALMONELLOSIS

As we well know, *salmonella* can be found in a wide range of food products such as raw eggs, poultry, pork, beef, other meat products and dairy products. Poultry products and eggs are the most common source of salmonellosis in many countries. In many cases, the origin of the infection is the farm. Contaminated feedstuffs are the most important vector of *salmonellae* into the farm, and neglected hygiene in feed and manure handling spreads the infection in herds. On the political decisionmaking level in the EU, using the words by Commissioner David Byrne, "salmonellosis is priority number one for us". Unionwide regulations have been proposed to reduce salmonella in animal populations. This is the most effective way to prevent the spread of infection via food. EU targets for this reduction policy are to be set progressively on the basis of scientific opinion, according to a fixed timetable. The proposed targets are to apply from 2005 onwards to breeding flocks of chicken, from 2006 onwards to laying hens, from 2007 onwards to broilers and from 2008 onwards to turkeys and breeding pigs. After a transitional period, marketing restrictions will apply to eggs from flocks suspected or confirmed of harboring specific types on salmonella. Poultry meat will also have to comply with set microbiological criteria from 2009 onwards (Regulation of the European Parliament and of the Council on the control of salmonella and other food-borne zoonotic agents and amending Council Directives 64/432/EEC, 72/462/EEC and 90/539/EEC).

In some countries, more strict regulations are already in use. In the EU, the so-called Zoonosis Directive 92/117/EEC includes surveillance of salmonella in poultry breeder production. In Finland, the control of salmonella has been organized through voluntary industrial measures and mandatory rules and regulations since the 1960s. For example, for over 40 years the Feedstuff Act has been applied to salmonella in feedstuffs. When Finland joined the European Union in 1995, the prevalence of salmonella infections was low. Therefore, the EU granted Finland special permission to run its own salmonella control program in meat and egg production. In practice, we are allowed to demand the same level of salmonella protection in a variety of imported products, which has been very important in this program. An investigation of our national salmonella prevention program and its efficiency evaluation methodology is underway (Maijala et al. 2003). The methodology currently includes quantitative risk assessment, identification of incentive structures, as well as cost-of-illness and willingness-to-pay analyses.

STRUCTURE AND RESULTS OF THE FINNISH SALMONELLA CONTROL PROGRAM

The original objective of the Finnish salmonella control program is to maintain the national prevalence of all the serotypes of salmonella below 1% and the prevalence at individual abattoirs or

cutting plants below 5% (Hirn 1997). The salmonella control of pigs in Finland is based on random sampling at slaughter and in cutting plants. Altogether 12 000 lymph node, surface swab and cutting plants samples are taken annually. On farms, fecal samples are examined from boars sold to artificial insemination stations and from pig herds included in the voluntary health control scheme, as well as from all cases where salmonellosis is suspected. In cattle, the same extent of procedures and the same sampling principles are performed. In poultry production, broilers, turkeys, geese, guinea fowl, ducks and egg-producing birds are examined at all production stages including hatcheries. The sampling is performed at regular intervals, targeting the introduction of new animals to poultry houses, follow-up during the production period (e.g. laying) as well as acquiring of information before the birds are sent for slaughter. Poultry meat cutting plans are also sampled regularly.

Detection of salmonella on farm, abattoir or cutting plant always leads to legislative measures, including epidemiological investigations, restrictions on the sale purchase of animals and products contaminated by salmonella, disinfection procedures, as well as special arrangements for slaughtering.

Less than 5% of broiler flocks were salmonella positive at the age of 4-5 weeks in 1989-1993. The target level of less than 1% has been achieved during several years. The most common serotype isolated from broiler flocks has been *Salmonella infantis*. Between 1995 and 2001, salmonella has been detected only twice in broiler breeder flocks; and as mentioned, all flocks are sampled regularly. Higher figures have been detected at the cutting plants samples. In 1995, 9.4% of the samples were positive. After 1997, the figure was down to less than 1%.

During this program, in egg production, salmonella has never been detected in breeder flocks. In layer flocks, the prevalence has been well below the 1% target level. The most common serotype detected has been *Salmonella typhimurium*.

In cattle and swine production, salmonella is seldom isolated on the farm level. The highest number of reported salmonella-positive cattle farms was 287 (out of 38 700 farms) in 1995. This number has gradually been decreasing, with only 11 farms (out of 22 700 farms) in 2001. The salmonella prevalence in lymph nodes as well as in carcass swabs taken from sows, fattening pigs and cattle at the abattoirs has remained well below 1% in 1995-2001. Also in these samples, the most common serotypes detected have been *Salmonella infantis* and *Salmonella typhimurium*.

The Finnish salmonella control program and its results have been presented in some detail because this is a control program in which surveillance (including control measures) mainly focuses on primary production. The measures are typically based on the knowledge and methods of the animal hygiene profession. The health benefits are gained at the consumer level, i.e. at the end of the production chain.

EVALUATION OF PROGRAM

Prof. Maijala, using transmission models, has quantitatively evaluated the effects of interventions used in the Finnish salmonella control program. Some results have already been published. The results from the primary production model of broilers show that the number of human salmonella cases caused by broiler meat would increase sixfold if the Finnish salmonella control program were not in force (Ranta & Maijala 2002). However, several interventions used in the program, e.g. imposing restrictive orders, cleaning and disinfecting the broiler houses as well as voluntary interventions such as the use of competitive exclusion (Nurmi & Rantala 1973), were not included in the model. Therefore, the model created is likely to underestimate the effect of salmonella control.

According to the analyses by professor Maijala's research group, the cost-benefit ratio for egg production was 19.8 (and with market adjustments 61.2). The cost-benefit ratios for meat production was 5.4 (and with market adjustment much higher 258.1). Reported per household, the estimated benefits were 3.5 euros annually (Maijala & Peltola 2002). The Finnish salmonella control program is evidently very justified.

LISTERIA

In Finland in 1999, 1, 0% of 1432 milk and milk product samples were positive for *Listeria monocytogenes*. In meat and meat products including poultry, however, this share was 9% and in fish 7.5% (Annual report of National Veterinary and Food Research Institute).

One listeria outbreak in a dairy delivering 100 million liters of milk per year can inflict shutdown and sanitation costs of about one million euros or 4 eurocents per liter.

EHEC

EHEC is not a zoonosis, because the animals carrying this bacterium are not diseased. But it is a dangerous microbe to us humans, and the infections have caused plenty of discussions in media.

In Finland, a national survey in 1997 showed 1.5 percent of cattle at slaughter carried EHEC. This is internationally a low figure, but we still have a national program to diminish the risks of human EHEC-infections.

This year, 2003, we have begun to sample some 1500 cattle at slaughter. Feces and swab samples will be analyzed in the National Veterinary and Food Research Institute. If positive results become apparent, the local veterinary officer visits the farm with together a herd health veterinarian. They look at the cleanness of animals and risks of fecal contaminations in the cow house. They give to the farmer a risk control proposal where feed, feeding and water hygiene, and internal feed and manure logistics on the farm are discussed.

The control advice for EHEC recommends the farmers to keep feed tables, vessels and water cups clean, keep feed and feces very strictly separated, to maintain good milking hygiene, to send to slaughter only clean animals, and always to wash hands when departing the cow house for home. In case of diarrhea in a dairy farmer's family, investigation of fecal samples is recommended.

In slaughterhouses, high level of hygiene is needed to avoid the contamination of meat by fecal microbes. In case of dirty animals, special attention shall be paid during the slaughter process. In dairies producing non-pasteurized products, a special self-control program for EHEC is needed. And last but not least, personal hygiene at home, especially washing of hands before handling of foodstuffs, is an important preventive measure. Feeds must be stored and handled properly, meat must cook or bake completely, and the storage temperature must be low enough. Raw meat and done meat must be kept separately.

In Finland, statutory sampling in all abattoirs will start in 2004. The results of the 2003 investigation will be used in the future issuing of orders.

HYGIENE ON FARMS

To avoid the spread of fecal pathogenic bacteria, good hygiene practices have to be followed on farms. Sectioning and 'all in, all out' measures are recommended for control and eradication of infections on farm. Thorough cleaning between batches, and at least once a year, is obligatory. At the same occasion, worn and broken parts of boxes etc. must be repaired or replaced.

A dry and clean lying place promotes the cleanness of animals. Warm water for washing of hand and boots should be provided. Boots and clothes for visitors should be available on every animal unit. Any unnecessary visits to animal rooms should be prohibited.

Feed hygiene is an elementary part of the prevention of feces transmitted zoonoses. Already on field, the contamination of grass, hay and silage by manure is a real risk of infections. Storage rooms should be protected from rats and birds as thoroughly as possible. Transportation of feed from storage to feeding table or trough can often lead to the contamination of feed by manure. This must be taken in consideration already in the planning of buildings to prevent this risk. Animals must not be allowed to walk on feeding tables, and people working in the barn should also avoid walking from a dirty stall directly to the feeding table. Dirty drinking bowls are often a source of contamination as well.

Manure handling inside the animal buildings should be planned and performed so that the risk of feed contamination is minimized. The transportation of slurry and manure from the storage to field should be done in such a way that feed alleys and feed transportation systems cannot be infected. E.g. the use of a tractor in feed transportation after it has been used to spread manure over the soil can be very risky if the tires are not cleaned properly.

Good milking hygiene prevents the contamination of milk during milking and in the milk tank. Cleaning of milking parlors or tying stalls before milking is important. The milker's hands should be washed and all the equipment has to be clean. In wiping the udder, excessive use of water should be avoided, and disposable or thoroughly washed clean cloth must be used.

CONCLUSION

This short overview shows that the 'stable to table' approach is an elementary precondition to good public health policy. To protect our citizens from zoonoses and food borne diseases, we need many measures of varying types. Legislation, also on the international level, is needed if we want to keep the borders open for international trade of foods and feedstuffs. On the national level, continuous and well-planned control programs are needed. Sampling must cover feeds, breeding and production animals in different production phases, dairies, abattoirs and egg-packing plants, and also retailers and distributors. Good management practices on all levels, but especially good hygiene on farms, is of extreme importance. National disease surveillance and scientific analyses of the effects and socioeconomic results of control programs are needed for further motivation of control measures.

Good results have been achieved when professional animal hygiene principles are used on the national level. The Finnish Salmonella Control Program is one good example of such a success.

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