Setting up a successful salmonella control program

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Salmonella infections pose a risk to public health and these infections can sometimes occur. Although Salmonella spp are not normally present in pork itself, contamination of the pork with Salmonella spp can be a threat to the public. Infection with Salmonella typhimurium can lead to severe gastrointestinal disorders in man, but other Salmonella spp can also be of significance.

In order to minimise the risk of infections, a salmonella control program can be of help. For this reason in many countries salmonella programs have been established and have proven to be successful. But, before starting such a program, decisions have to be made in order to establish a certain level of safety.

The two main tools that are used are serological surveillance and sampling (culturing) of swine carcases. Both techniques have their own benefits and limitations and these have to be taken into consideration before starting any program.

Serology and sampling

Serology will tell the history of the animals or farms as sampling carcases will give information on the current situation of the meat product itself. Serology and carcase sampling are poorly correlated to each other so a decision has to be made on what strategy the program will be based. Both strategies will be useful but people have to be aware about the differences between these two approaches. Samples have to be taken easily with a low cost and laboratory techniques have to fulfill the same requirements.

In general, two different stages in the pork production can be defined - the farming operation and the slaughtering process. Each of these two stages has its own characteristics but they are linked to each other. So, in this way, these two stages can not be seen separately – they have to be viewed as a whole process.

With this in mind we need a good definition that outlines what the aim of the control program will be and which decisions have to be made. Only then can a level of safety be given to the meat products. Serology is often used in salmonella control programs. Serum samples can easily be taken from pigs by sampling live animals or sampling pigs at slaughter. Meat juice is often used as a replacement for serum in monitoring programs. The benefit of these samples is that they are easily taken after slaughtering the pigs without any time pressure.

Serum samples and meat juice samples are comparable to each other in certain aspects, but are also different. Using serological techniques, these have to be comparable to each other to ensure that laboratory results give the same answer. But, to date, there is quite a large data set available and a lot of experience that supports comparison.

People have to remember that serology will only explain what has happened in the past. The agent, in this case the salmonella bacterium, has to interact with the host to set off an immune response.

This immune response will produce antibodies that can be detected from a certain point onwards. This approach will tell us the status of the herds and based on this information herds can be discriminated from free to heavily infected.

It is known that the outcome of serology, especially for ELISA results, is correlated with the degree of infection in herds and, with this approach, farm status or herd status can be identified. By knowing statuses, decisions can be made in the whole process.

The first control can be done by management on the farm to decrease or limit infections with Salmonella spp. The second control can be done by identifying infected herds and deciding when finishers will be slaughtered, for example at the end of the day. Both ways will help slaughterhouses to minimise the risks.

In the past for serology tube agglutination was used. Although the technique itself was not that complicated, there were pitfalls.

The biggest disadvantage for this technique is that in large scale programs it is not suitable due to its laborious nature. As soon as ELISA technique became available the possibilities for large scale serological screening were there. The ELISA technique is a robust technique and is suitable for automation.

Due to all the effort that has been put into the development of this technique, ELISA is now suitable for almost every laboratory and its costs are low. In addition, due to the fact that different ELISAs have been standardised, results from different brands and also results from other countries can be compared. Therefore, in international trade, results of any certified laboratory can be trusted and used.

A new technique is Surface Plasmon Resonance (SPR). Although some people are strongly convinced that this will be the new technique, to date it is not fit for large scale screening due to low throughput.

Also, the cost is still a point of concern, but perhaps in the future this technique will evolve to be a suitable tool. So, until then, ELISA is the most used technique in control programs.

Culture

Sampling carcases in the slaughterhouse is another approach to determine a certain level of safety. In contrast with serology, culture is looking at the present. People have to bear in mind that salmonella bacteria are not normally in the meat of pigs, which means that all salmonella which can be detected on the surface of carcases are a result of contamination.

There are different sources of contamination to be found in slaughterhouses such as the first is the pig itself or the personnel working in the slaughterhouse. However, it can be concluded that contamination is a matter of hygiene during the whole slaughtering process.

Monitoring pigs before entering the slaughterhouse improves safety as what is not present will not lead to problems. So, if pigs are free of salmonella contamination, the pig itself is less of an issue and human borne contamination is more of concern. This makes serology the stronger tool to monitor herds before entering the slaughterhouse. But culture is a stronger tool to monitor contamination despite the source. Eventually, pork will go to the consumer and it has to be safe! With this thought, culture will give a better indication of food safety

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than serology. Thus, the discussion as to which technique is preferable has begun.

With different techniques available discussion will arise about how to design a salmonella control program. But, before starting such a program, the decision has to be made about what it should control. It is too simple to say that all programs give the same safety level.

Monitoring herds and control herds can lead to salmonella free herds. These herds can be an advantage for slaughterhouses and in some countries a controlled delivery of pigs to the slaughterhouse is common practice.

In this approach, the philosophy is that what is not there gives no problems. But human borne infection in slaughterhouses are not considered by swine serology.

Also, very recent infections in the pigs will not be detected for the reason that the immune response to salmonella infection will take some time to develop. It is well known that during transport and in slaughterhouses new infection can occur and these infections will not be detected by serology. But, despite these shortfalls, serology is often used in national control programs and there is plenty of good experience with this approach.

This means that a program based on serology can be a successful program as long as people are aware of all its pitfalls.

In this approach almost all efforts are concentrated on the farm phase. Farmers will pay for all the research on their farm, but most of the benefits will be in the slaughterhouse. So, this will always raise the question if it will be possible to undertake the monitoring inside slaughterhouses.

This approach will not only tell something about herd level, but also include other sources of contamination. It is well known and described that there is a poor correlation between serology and culture and for that reason people have to be aware that determining herd status by culture is very tricky. But, on the other hand, monitoring the whole slaughter process will produce a safer consumer product as culture will define the present status of the pork.

In Europe a baseline study showed very different patterns within different countries when serology and culture were compared to each other. The different patterns could be described as low seroprevalence with low culture prevalence, high seroprevalence and high culture prevalence and other combinations of the two.

The first pattern is clear, the whole process seems to be in control. The second pattern is more disturbing, despite the fact that salmonella is unlikely to be present in the pork, the whole process will lead to contamination and an unsafe product. The combination of low seroprevalence with high culture prevalence indicates an unhygienic slaughter process and the combination of high seroprevalence and low culture prevalence shows a very good controlled slaughter process.

The lesson which can be learned from the European baseline study is that people should be aware of what is going on in herds and slaughterhouses. Knowing what is going on enables decisions to be made about what to control and what approach is the most reasonable.

There is not a good or a bad approach, but only different ones. Monitoring herds by serology seems to be successful, especially when it is possible to set up a logistic slaughter process with a high hygienic standard.

Monitoring slaughterhouses by culture can also lead to a safe product. But culture will not give a good monitoring system for farms due to many other sources of contamination. That means the decision has to be made about what the monitoring should mean before setting up a program. Only then will a smart approach be there so that a safe product is on the market.

Conclusion

Both serology and culture can be used. Serology is used in several national programs with great success. Culture can be used in controlling the whole process. Both approaches have their advantages and disadvantages and based on what is to be controlled a decision has to be made about how to set up this control program. ■