

THE USE OF BLOOD ANALYSIS IN THE INTEGRATED PIG PRODUCTION CHAIN - ANIMAL HEALTH AND WELFARE, MEAT SAFETY AND SENSORY QUALITY-

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Background:

Healthy animals on the farm are the basis for safe and wholesome meat production. Monitoring herd health in pigs at the farm and at slaughter has been developed in several countries using different systems. Projects like Integrated Quality Control (IQC) use the feed and medication data collected during production along with the recorded post mortem lesions, to monitor herd health at the farm. Research on these different forms of IQC in animal production has shown that analysis of blood of animals at slaughter can provide useful information to the benefit of animal health and human health. Furthermore, several serological studies for different agents on pigs during the finishing period have been performed in Europe. Taken together these have shown that the use of blood analysis in IQC can contribute to better surveillance of animal health and welfare and to the quality and safety of meat throughout the production chain. In addition, blood analysis at the slaughter line can provide additional valuable information for meat inspection. Therefore, in 1995 the Dutch Product Boards for Livestock, Meat and Eggs have initiated and largely financed an extended project on blood analysis of pigs in the slaughterline. The Dutch Ministry of Agriculture also financed a major part of the project. The remaining costs were paid by the seven Dutch research institutes that took part in the project.

Objectives:

The main objective of the project was to develop equipment for automated blood sampling as well as equipment for automated blood analysis in the slaughter line. In this system the blood has to be analysed in a limited time on a large number of parameters for the use of blood for modernising meat inspection and the use of blood as carrier of information for other purposes, such as monitoring of contagious animal diseases (Classical Swine Fever, Aujeszky Disease, Swine Vesicular Disease), management of the farmer, quality selection in the slaughterplant for customers, and Salmonella-screening.

Equipment and tests to be developed

For an effective and efficient way of collecting blood of pigs an automated sampling method at time of sticking in the slaughterline had to be developed. Obviously, a reliable identification system for the blood samples, corresponding to the identification code of the animal had to be developed as well. Furthermore, equipment had to be developed in which blood can be automatically analysed in the slaughterplant on a large number of parameters within a limited period of time. Regarding some of the applications mentioned above the results of the analysis on certain blood parameters have to be available early post mortem. For example in case results are used for meat inspection they have to be available within about 45 minutes post mortem. Therefore not only the 'hardware' (equipment) for the blood analysis had to be developed, but also rapid mini (needing a small test volume) tests (ELISA's, using monoclonal antibodies) were developed for the following parameters: Classical Swine Fever, Aujeszky Disease, Swine Vesicular Disease, Sulfonamides, Salmonella, Trichinella and Acute Phase Proteins. Furthermore experiments were conducted to study other applications of blood analysis in the slaughterline and a cost/benefit-analysis of the system has been performed.

Results and Discussion:

A prototype of an automated self-cleaning sampling system to be used at time of sticking in the slaughterline has been developed. At the moment the prototype is tested in practice in a commercial slaughterplant. The capacity of the prototype sampling machine is 80 animals per hour.

A prototype of an automated analysis system, a so-called MultiAnalysis System (MAS), has been developed and has to be tested in practice. The test-tubes with the blood samples are automatically transported from the sampling system to the MAS. In the MAS the blood is automatically diluted and distributed over the ELISA-test-holes. In the MAS about 25 parameters can be analysed in 1 blood sample.

The identification of the samples, in correspondence to the animal's electronic identification code (transponders), will be secured by fixing a read-out-unit to the hand of the person sticking the animal.

At this moment mini-ELISA's for application in the MAS are available for the majority of the parameters mentioned above. Testing times range from 60 minutes up to a few hours. Some of the tests need further development, the other mini-ELISA's are ready for testing in the prototype MAS.

Acute Phase Proteins can be used as indicators of pathological lesions in pigs prior to slaughter or in carcasses at meat inspection. Experiments showed also that an index of Acute Phase Proteins can be used for measuring the health and disease activity of animals. These parameters may also be useful in predicting meat quality. At present monoclonal antibodies against 3 Acute Phase Proteins are prepared for MAS-tests.

Other blood parameters that might be useful in predicting stress and thereby meat quality are subjects for future research. These parameters can also be useful for determination of welfare.

Measuring a large number of haematological and clinicochemical blood parameters indicated a fair correlation between pig growth and blood parameters. Further research is necessary to define a Health-index, composed of various blood parameters measured in the MAS, which can be used as input for farm management.

The cost/benefit-analysis indicates a positive result for the provisional results of the blood sampling and analysis (in the Dutch situation).

Conclusion:

Automated blood sampling and analysis in the slaughterline on various parameters in a limited time period is possible and offers good opportunities for monitoring of contagious animal diseases (Classical Swine Fever, Aujeszky Disease, Swine Vesicular Disease), modernising meat inspection, management of the farmer, quality selection in the slaughterplant for customers, and Salmonella- and Trichinella-screening.

In summary it can be stated that blood analysis in the slaughterline is an appropriate device to monitor, control and improve animal health and welfare, and meat safety and sensory quality.

Literature:

Most of the equipment developing work is described in internal reports (in Dutch) and will be patented. Some of the more fundamental work is published in international scientific journals. Those who are interested are requested to contact the author of this paper (S.J.W.Hillebrand@pve.agro.nl).