

„ Vaccination via water begins to become a well used option“

The production of oral vaccines for administration via drinking water is a subject of investigation in the industrial pig production. The key success factors [for oral vaccines] are revealed in this interview, their difficulty in manufacturing and their efficacy against major swine diseases.

If you look for a vaccine that protects against a disease, you don't consider only the ease of application or complexity of trials in the lab, you want to know how it performs in the industrial pig production, which need to think beyond this. A more intensive production and an increase of number of pigs in farming and also the new rules of animal welfare lead to the administration of oral vaccines as selection criteria. Steven McOrist, one of the opinion leaders for that issue, provides the details of the principal advantages of oral vaccines.

1. *“Which are the advantages of water as the route of administration in pig production?”*

The first advantage is the elimination of stress for the animal by using drinking water and the reduction of effort, costs and time for the personal working in the farm (including the possible difficulties and damages to the one administrator) when compared to numerous individual mass vaccinations.

Other advantages include the elimination of a possible transmission of infections via the needle (like the PRRS virus when multi-use needles are used) and also possible local reactions in the meat. The most used adjuvants in injectable vaccines may cause persistent necrotizing lesions in the muscles of pigs. Moreover, recent research has shown that certain adjuvants that are necessary to obtain a good efficacy [in vaccination via needle] are responsible for immuno-potentiation of latent PCV2 infections.

2. *“Is there a comparable efficacy of this type of vaccines?”*

Vaccination of pigs by means of drinking water is used a lot in North America to combat three typical diseases in pig production: Erysipelas, Salmonella and ileitis. Each of these infections is important in the weaning and in the fattening period. The administration of the vaccine in water is in each case easy in the post-weaning period and it enables that the animals acquire a protective immunity.

There are three different vaccines against Erysipelas commercially available in the U.S., all are based on similar attenuated strains. These vaccines are very effective in the control of this disease.

In the case of salmonellosis, there is only one vaccine available and is extensively used. There are also various studies investigating a vaccine against enterotoxigenic Escherichia coli in the post-weaning period, but no commercial product is available. Regarding ileitis, there is an oral vaccine which is used also in Europe; for which a great efficacy has been demonstrated if the product is used with a correct protocol.

3. *“Do you have a preference when it comes to select a particular disease to investigate the possible utilization of an oral vaccine?”*

Vaccination via water is just after the begin an option for a large distribution in pig production. The three aforementioned diseases (Erysipelas, salmonellosis and ileitis) –

for which commercial products are available - are bacterial diseases which affect pigs post-weaning.

Companies that work with vaccines, make it with strains of *M.hyo*, *H.parasuis* and *App*, which might be appropriate also for oral administration in the water. Attenuated strains of *Mycoplasma* and *Haemophilus* that fulfil these requirements are widely used in poultry production since various years of investigation.

Diseases caused by parasites are not very common in the post-weaning period in modern pig production systems, whereas viral infections are very well controlled by injectable vaccines in European pig production.

4. *“Which are the critical elements in those investigations, if there are any?”*

Above all, finding an adequate isolate or attenuated strain of the causative agent, which can be cultivated in the lab and which grows in huge quantities. Furthermore, they need to have the majority of the virulence factors that control the infectivity, which means they have to grow in the host to a certain extent. Nevertheless, they need to lack if those virulence factors that are necessary for a clinical expression of the disease. Some researchers have addressed this difficulty by implementing genes of the bacteria concerned into *E.coli*, producing a subunit vaccine. In this subunit vaccine, *E. coli* expresses one or more protein factors of virulence. This experience has been demonstrated for some viruses, but not for bacteria. The reason for this is that bacteria have dozens of virulence factors that can not be easily integrated in *E.coli* subunit vaccines.

5. *“Which is the key point to obtain success when you investigate this type of vaccines?”*

The most important is finding or creating an isolate or strain adequately attenuated of the causal agent. In this way such a vaccine will contain the majority of the necessary factors that enables that the host recognises the causal agent and that he can develop an appropriate immune response. If the isolate is sufficiently strong it can be used in experimental research for mass vaccination. In general, the host “consumes” the attenuated strain, which lead to acquire a protective immunity before he is exposed to the “normal pathogen”.

6. *“How do you develop such oral vaccines (in brief)?”*

Developing an attenuated isolate of an infectious agent is usually realised by gene deletion. An infectious agent is modified in this manner by eliminating genes for the virulence, but retaining genes that determine the infectivity. This can be done by simple cell passages in the lab or sophisticated methods of gene manipulation.

7. *“Do you think that a major investment is necessary as far as companies are concerned for this type of projects?”*

Various groups of investigators are working on isolates or strains of Mycoplasma, Haemophilus and Actinobacillus. The actual options that exist for the immunisation against these three diseases have some problems: in the efficacy, in the method of administration or in subtypes of pathogens. More investigations are always welcome, because of the numerous strains which are to be evaluated and the possible few that are adequate to be tested.

8. *“Does vaccination via water improve the wellbeing of the animal in your opinion?”*

There is a considerable improvement of the wellbeing of the animals by using vaccination methods by the oral route or via water. You avoid injections. As well as improving the wellbeing of the animals, the personnel of the farm also saves work. It is also an effective method which enables the prevention of painful and severe diseases like ileitis. It is probable that the proportion of pigs that really drink the vaccine when it is administered via drinking water is not different to administration of common inoculation techniques (some animals are injected twice and others not at all).

9. *“In conclusion, which is the main message which you like to transmit for oral vaccines by water?”*

The huge varieties of problems that we encounter with injectable vaccines are great obstacles for the industrial pig production. The methods of mass vaccination [via the oral route] is largely used in poultry farms since a lot of years and it is also used more and more in pig production. In particular, the huge problems that appear at the time of injecting vaccines to pigs post weaning support a change to vaccines in water in this age group. The development of vaccines for oral administration in water enables a development of effective immunity against main diseases that affect fattening pigs.