CamCon

Campylobacter control - novel approaches in primary poultry production

Deliverable 4.5.1: Report on future data needs
Deliverable was due Month 04-2015 and was delivered on time

Authors: Nauta, M.J., Van Wagenberg, C.P.A., Sommer, H.M., Borck Høg, B., Van Horne, P.L.M. and Rosenquist, H.

The Future data needs for Risk Assessment and Cost Effectiveness studies for Control of *Campylobacter* in broiler meat, identified in CamCon.

In CamCon WP4 the currently available data for risk assessment activities for *Campylobacter* in broiler meat have been studied and reported (Rosenquist et al 2015, deliverable 4.2.1.).
Data needs for future risk assessment activities, as well as cost benefit analysis including economic data, have been identified.

On farm risk factor studies (Deliverable 4.1.1.b and 1.1.3.)
The data which all analyses is based upon should be of a high quality in order to obtain useful and significant results in a risk factor study and to obtain a proper identification of effective interventions. The data set should

1) be representative, which means that all known strata should be included, preferably according to their sizes.
2) have as few missing values as possible, preferable none. First of all, it may not be possible to run a model with relatively many parameters due to missing values. Secondly, they may have a significant effect on the conclusions if the missing values are missing systematically and thereby reduce the representativeness, which may bias the inferences about the population. Thirdly, missing values imply a loss of information which often results in less efficient estimates of the parameters. Thus a large number of missing values often complicates the analyses of data.
3) be large in order to cover as many combinations of the explanatory variables as possible, in order to increase the power of the test and thereby be able to identify important risk factors, and in order to obtain efficient estimates of the parameters
4) be based on a well designed study including the design of the questionnaire, which should not only be suitable for communication with farmers, but also suitable for statistical analysis. The questionnaire should preferable have the unit of the broiler house instead of the broiler farm which tends to average out the effect of a risk factor if the conditions in the different houses vary. The answer-categories should for each question cover the whole sample space with no overlaps making the interpretation of the answers useful.
5) Include new variables that potentially would be able to explain more of the variation between the countries. Remove if necessary some of the variables that do not appear to be significant to enable the model to run.

Food chain risk assessment
Even though increasing amounts of quantitative data on the prevalence and concentrations of *Campylobacter* during processing become available (e.g. studies from T. Seliwiorstow and E. Pacholewic), there are various factors that complicate the use of these data. One problem is that it is essential to obtain a good description of the variation in concentrations both within and between flocks/batches. Another problem is that studies on the dynamics of cross contamination in the

slaughterhouse show that models describing changes in concentrations in terms of log increase and log decrease only may not be sufficient (Nauta et al 2005).

A general challenge is the occurrence of missing and censored data. This requires simplifying assumptions that may impact the interpretation of the data, or may require novel statistical techniques for the interpretation of data. Some progress in this area is made (e.g. Duarte et al. 2015), but more progress is required. A typical example is the lack of availability of user friendly tools to do regression analyses with censored data. Such analyses are crucial for a data based approached to describe changes in concentration over the processing steps, or correlations in concentrations between different matrices (e.g. Laureano et al 2013).

Another issue is the lack of combined data sets. To appropriately model the transmission dynamics of *Campylobacter* during processing, one should have data on cecal concentrations, fecal concentrations, crop concentrations, and concentrations at the exterior at different stages of processing. Laureano et al (2013) collected such data, but unfortunately didn't collect individual samples, but pooled samples, which are not easily interpreted. There is also a need to translate data obtained from carcass washes, neck skin samples, other skin samples, surface samples to each other. Some small data sets are available (e.g. Johannessen, in Rosenquist et al 2015, deliverable 4.2.1.), but suffer from censored data.

A conclusion may be that the collection of new small data sets without a specific predefined purpose will not be very useful. The objective of the sampling and the method to be applied for data analysis have to be determined beforehand, preferably attended by a power analysis. It is likely that the data demands following such an exercise are high.

The risk assessment model used to link concentration data on skins samples to risk assumes that the difference between the concentration found on the skin samples and meat is one log (e.g. Nauta et al. 2012). Data to support or modify this assumption are needed.

As it is expected that PCR techniques and similar new quantitative molecular methods will be increasingly applied in the future, it is important to get a clear insight how these data relate to existing data, obtained by culture methods.

Economic analyses

To estimate the costs of farm-level interventions in different countries, it is necessary to consider total production costs and revenues on farm level in these countries. No database exists that combines all necessary country specific technical and economic farm performance data, that is comparable across the countries. Therefore, in CamCon (Deliverable 4.3.1), we gathered these data using project partners in each of the six participating countries. Furthermore, we used a typical farm in each country and only gathered data for such a typical farm. This already proved rather difficult. There is a need for more detailed country specific technical and economic farm performance data including the variance between farms within each country (e.g. due to region, breeds, housing system), to be able to assess the differences in costs between different farms.

Cost effectiveness analysis

Cost effectiveness of interventions to reduce the human health risk of acquiring campylobacteriosis through the consumption of broiler meat can only be done on the basis of a set of assumptions and generalisations. It is for example crucial to know the attributable fraction of broiler meat in the incidence of campylobacteriosis in different countries. So far this is based on a limited number of studies, and differences between countries are largely unknown.

In CamCon (deliverable 4.4.1.) we estimated the public health gains of improved *Campylobacter* control on broiler farms as a reduction in disease burden quantified by the number of averted

DALY. Improved *Campylobacter* control will also result in a reduced cost-of-illness of human *Campylobacter* infections. A sound estimate of the cost-of-illness is only available for specific countries, but not for all the six countries from this study. A sound estimate of the cost-of-illness of human *Campylobacter* infections of each of the European countries can improve the expected cost-effectiveness of *Campylobacter* interventions.

References

Duarte, A.S.R., Stockmar, A. and Nauta, M.J. 2015 Fitting a distribution to microbial counts: Making sense of zeroes. **International Journal of Food Microbiology** 196:40-50.

Laureano, L., Corujo, A and Van Gerwe, T. 2013 Correlation of different matrix with Campylobacter counts in neck skin of broiler carcasses. 17th International Workshop on Campylobacter, Helicobacter and Related Organisms, Conference proceedings pp. 123. Aberdeen, UK.

Nauta, M.J., Van der Fels-Klerx, H.J., Havelaar, A.H 2005 A poultry processing model for quantitative microbiological risk assessment **Risk Analysis***, 25*(1), 85-98..

Nauta, M.J, Sanaa, M., Havelaar, A.H. 2012 Risk based microbiological criteria for Campylobacter in broiler meat in the European Union. **International Journal of Food Microbiology** 158:209-217.