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International strategies to reduce the incidence of Campylobacter in broiler flocks

Werner Strydom

July 2015

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A Nuffield (UK) Farming Scholarships Trust Report

Date of report: July 2015

"Leading positive change in agriculture. Inspiring passion and potential in people."

Title	International strategies to reduce the incidence of Campylobacter in broiler flocks
Scholar	Werner Strydom
Sponsor	Aviagen, Cobb and Hubbard Breeders
Objectives of Study Tour	To investigate how other countries have successfully reduced the number of people contracting Campylobacter from chicken meat.
Countries Visited	New Zealand, Norway, Denmark, Sweden, USA and Iceland.

Messages

- We *can* reduce Campylobacter on poultry farms.
- A national Campylobacter Monitoring Programme will drive improvement. "What gets measured gets managed."
- The thinning of broiler sheds should be avoided where possible or phased out altogether.
- The acceptable stocking density in non-thinned programmes should be reviewed with the view to it being increased.
- We need to have Government support to avoid UK chicken being undermined by cheaper imports.
- We need to improve biosecurity on broiler farms to control all pathogens, not just Campylobacter.

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DISCLAIMER

The opinions expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, or of my sponsors Aviagen, Cobb and Hubbard Breeders, or of any other sponsoring body.

CONTACT DETAILS

Werner Strydom
24 Ash Tree Close
Occold
Eye
Suffolk
IP23 7LD

Telephone: 07967677091

Email: werner_strydom@hook2sisters.co.uk

Blog: https://wernerstrydom17.wordpress.com/

Nuffield Farming Scholars are available to speak to NFU Branches, Agricultural Discussion Groups and similar organisations .

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Southill Farmhouse, Staple Fitzpaine, Taunton TA3 5SH
Tel : 01460 234012
email : director@nuffieldscholar.org
www.nuffieldscholar.org

Chapter 1. Introduction

I grew up on a beef and sheep farm near Burgersdorp in the North-Eastern Cape of South Africa. I first got involved with broiler production at the age of 14 when I started rearing batches of 25 broiler chickens on my dad's farm. We processed and packed the birds on the farm and I sold the birds to neighbouring farmers' wives and to the nurses at our local hospital. I did this until I finished school and moved to the UK.

I have lived in the UK since 2000 and have spent all that time working in farming in the South of England. I obtained my B.Sc. (Hons) degree in Agriculture with Business Management at Writtle College in Chelmsford, Essex, in 2007. This is where I met my wife, Caetlyn, who at that time was studying Conservation. On completing my degree we moved to Eye in Suffolk and I have been working in broiler production ever since. I currently work as General Broiler Manager for Hook2Sisters Ltd - Central & Southern regions, supplying chickens to 2 Sisters Food Group. In May 2014 my wife and I welcomed our son, William, into the world.

I have been involved with the poultry industry's Joint Working Group project to set up model farms to see if, by adhering to the highest level of biosecurity, we can reduce the level of Campylobacter in the birds produced at these sites. My involvement with this project is what led me to apply for a Nuffield Farming Scholarship in order to research more widely how to reduce Campylobacter in the UK food chain.

Figure 1 - My wife, Caetlyn, our son William and myself

Chapter 2. Background to my study subject

Campylobacter is the most common cause of food poisoning in the UK. It is considered to be responsible for more than 280,000 cases each year with 72,000 of these cases confirmed by laboratory reports. The Food Standards Agency, or FSA, estimates that Campylobacter causes more than 100 deaths a year and costs the UK economy about £900 million (*Food Standards Agency, 2015*).

About four out of five cases of Campylobacter poisoning in the UK come from contaminated poultry meat. Campylobacter is also found in red meat, unpasteurised milk and untreated water. Although Campylobacter does not normally grow in food, it spreads easily and has a low infective dose; so it only needs a few bacteria in a piece of undercooked chicken to cause illness *(Food Standards Agency, 2015*). The FSA has made Campylobacter their number one priority and set up the Joint Working Group in order to get the industry and retailers to work together to reduce the levels in chicken products. I was involved with the On-Farm Biosecurity Group. The objective of this group was to set up model farms to see if the highest level of biosecurity could reduce the level of Campylobacter entering the food chain. The results of the trial work showed very little effect on the level of Campylobacter suggesting that the answer is not in biosecurity alone.

Something happened in the UK on 15 January, 2013, which had a very real impact on the UK poultry industry. Horsemeat DNA was found in beef burgers sold in several British supermarkets. Investigations brought to light that retailers have very little control over imported products as the supply chains are often complicated and traceability is difficult. In the aftermath of this scandal retailers pledged to supply a higher percentage of British products and several retailers pledged to sell *only* British chicken. We face the stark reality that the long term trend shows the number of people contracting Campylobacter is increasing. Our industry cannot continue to sell a product that could cause people to become ill, and have no accountability. It is time for us to act and we must do so quickly.

Our industry cannot continue to sell a product that could cause people to become ill, and have no accountability. It is time for us to act and we must do so quickly.

Other countries have managed to successfully reduce the number of Campylobacter-positive flocks. With less positive flocks, less contaminated meat enters their food chains and less people contract Campylobacter each year. I hope that by investigating what they have done we can come up with interventions that will make a difference in the UK, and establish what the cost of implementing these interventions is likely to be. Contrary to what many people in the industry say, I am convinced that we can put systems in place that will reduce the number of people contracting Campylobacter and thereby reduce the number of deaths and the incidence of serious illness. I hope that this report will help the poultry industry, retailers and authorities to realise that we can use the fight against Campylobacter as a force for positive change within the industry:

Reference: Food Standards Agency - Acting on Campylobacter Together. Available at: http://www.food.gov.uk/news-updates/campaigns/campylobacter/actnow (accessed 8 July 2015).

Chapter 3. My study tour

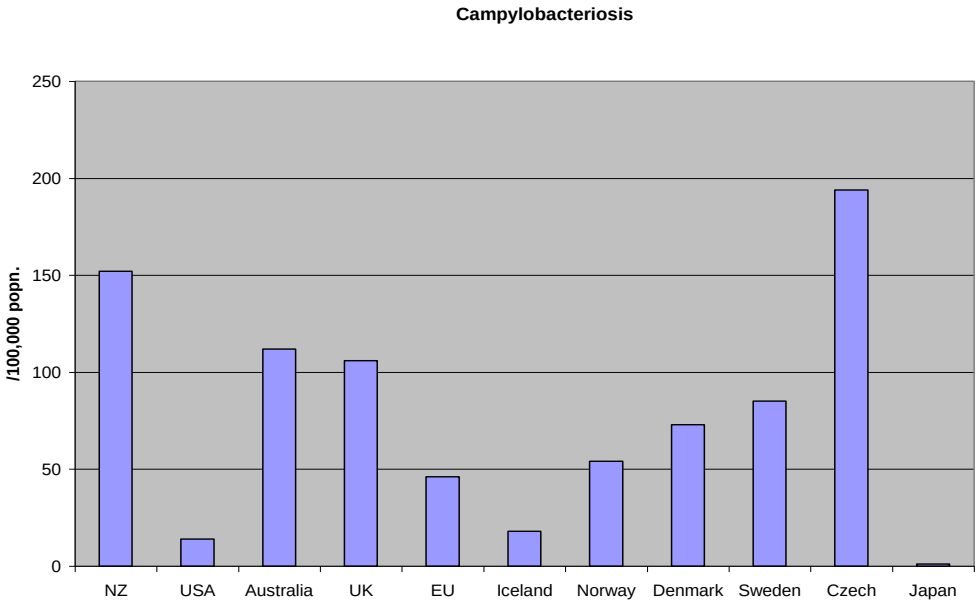

Figure 2: The number of Campylobacter cases per 100,000 head of population in the respective countries visited.

Country	When	Why
New Zealand	March 2014	Following the implementation of the Campylobacter Performance Targets in 2007 the number of people contracting Campylobacter has reduced from 450 cases per 100,000 people in the population to 150. Is the use of Chlorine in processing plants the answer?
Norway	September 2014	Norway is not part of the EU and has one of the lowest levels of Campylobacter in Europe. Broiler farms are restricted to producing no more than 140,000 broilers per year. Do lots of smaller farms help reduce the risk of flocks getting contaminated?
Denmark	November 2014	Danish farmers are so confident that they do not have Salmonella in broilers that they market their chicken as Salmonella-free. If they have managed to eradicate Salmonella can we follow the Danish model to eradicate Campylobacter?
Sweden	November 2014	Sweden is a world leader in developing and implementing animal monitoring systems. Is the world's oldest Campylobacter Monitoring Programme the reason why Sweden has nearly half the number of Campylobacter cases per 100,000 people each year compared to the UK?
USA : Arkansas, Georgia & Maryland	February 2015	The USA has some of the world's toughest food safety targets to meet and therefore allows the use of antimicrobials in processing plants. Would UK consumers accept chicken that has been produced as cheaply as possible with the carcasses being cleaned in processing plants?
Iceland	April 2015	Iceland has the lowest level of human cases of any country in Europe. Is the country's climate the key or do the Icelanders do things differently to other European countries?

Chapter 4. Campylobacter Monitoring Programmes

All the countries I visited have a mandatory Campylobacter Monitoring programme. It was interesting to discover that not one of these programmes is the same and each one has been developed to suit the needs of the individual country. In most cases the programmes were implemented and adapted over time. One thing that all the Monitoring Programmes have in common is that they forced the industries and authorities to work together to drive improvement forward. All the programmes are successful and have been shown to reduce the number of people getting food poisoning from Campylobacter.

There are 2 main strategies employed by the different countries.

- The first is to reduce birds to exposure on farm. This has been adopted by European countries where the use of antimicrobial washes in processing plants is not permitted. The main focus is in ensuring that the birds do not contract the bacteria on farm and thus have low levels on entering the processing plant.
- The second is pathogen reduction in the processing plants. This approach has been adopted by New Zealand and the USA where it is considered to be the most cost effective approach.

4.1. Norway

The Norwegian Monitoring Programme stipulates that all carcasses from Campylobacter-positive flocks must either be frozen or heat treated. Freezing has to be for more than 3 weeks and this is one of the most effective means of killing any Campylobacter on the carcasses.

It is required that a faecal sample is taken from all broiler flocks within 3 days of processing (4 if it falls over a weekend). The samples are tested by Polymerase Chain Reaction, or PCR, which tests for the presence of Campylobacter DNA, so it is difficult to destroy between sampling and testing. It therefore gives more accurate results compared to culturing the bacteria.

Other stipulations in the Norwegian programme are:

4.1.1. Drinking water

It is mandatory to treat borehole and well water with a UV light before it is given to broilers as drinking water. UV light kills campylobacter and other organisms in the water. There is also a big focus on sanitising drinker lines between flocks to remove biofilm from the lines. Campylobacter can potentially live inside the biofilm in drinker lines and contaminate the following flock.

4.1.2. Seasonal testing

It became clear that very few farms tested positive in the winter months. For this reason the testing regime was changed so that testing is only carried out between May and October.

4.1.3. Processing positive flocks last in the day

In the early years it was mandatory to process positive flocks last in the day to avoid cross contamination. A lot of work was carried out to understand the effect of cross contamination should a negative flock be processed after a positive flock. It was concluded that there was very little cross contamination so the programme was changed and this practice is no longer mandatory. However, as a matter of good practice, companies still process positive flocks at the end of the day where possible.

4.2. Iceland

After decades of only being able to sell frozen poultry products, Iceland started selling fresh poultry products in 1997. The human cases of Campylobacter escalated from 33 cases per 100,000 head of the population in 1996 to 156 cases per 100,000 people in 1999, most cases being attributed to chicken meat. The authorities reacted and introduced the Icelandic Monitoring Programme in 2000. This stipulated that all poultry products must be cooked or frozen unless it can be proven that the birds are free from Campylobacter. By the end of 2000 the human cases of Campylobacter had reduced to about 40 cases per 100,000 people per year, showing that the freezing policy had produced an immediate effect on the number of people contracting Campylobacter.

The industry had to work hard to regain the trust of consumers and today about 65% of chicken meat is sold fresh. Human cases of Campylobacter are currently around 15 cases per 100,000 people per year which is the lowest in Europe.

The stipulation is that testing on farm is carried out by testing 10 faecal samples collected no more than 5 days prior to processing. If there is no result or the sample goes missing, all the meat has to be frozen for a minimum of three weeks. Between the months of April and October producers are also required to test in the processing plant. This is to monitor the number of flocks that turn positive between testing on farm and processing. If a sample tests positive in processing the distribution is stopped and all remaining products are frozen.

Human cases of Campylobacter are currently around 15 cases per 100,000 people per year which is the lowest in Europe.

4.3. Denmark

The Danish Monitoring Programme stipulates that all broiler flocks must be tested in the processing plants. Twenty four caeca samples are tested from each broiler flock.

Previously, boot swabs were taken on farm to determine the number of positive flocks and also to see if the meat from positive flocks could be used for frozen products. This proved to be too difficult and the idea has since been abandoned. The decision to take caeca samples in the processing plant instead of boot swabs on farm was mainly to avoid missing any flocks that might turn positive after the boot swabs were taken. This form of testing also means that the results can be used to assess what the total levels were on farm. The results have allowed the Danes to build up a very extensive

database of positive flocks and the timing of outbreaks through the year. All the data collected is entered into a central management programme called KiK. This programme enables data to be analysed statistically and for trends to be identified. One of the trends that has been identified shows that farms scoring lower on the biosecurity part of KiK audits have a higher prevalence of Campylobacter.

In addition to the sampling of broiler flocks, 10 random thigh skin samples are taken weekly in each processing plant to monitor the quality of the processing. This is the standard testing method in processing plants in Denmark. Each part of the processing plant is also audited annually under the KiK programme to ensure that each machine is operating efficiently. The data generated from the different processes allows experts to target the processes that are not working well towards reducing the presence of Campylobacter in the birds being processed.

4.4. Sweden

The Swedish Campylobacter Monitoring Programme stipulates that all testing for Campylobacter is carried out in the processing plants. Ten caeca samples are tested from each house. This ensures that the most up to date results of positive flocks are obtained. Since caeca samples cannot be affected in transit, the levels can be linked to the level on farm.

The first mandatory monitoring programme for Campylobacter was started in 1988 and the industry's ambition is to have an equally low level of Campylobacter as there is Salmonella in broiler flocks. The programme has shown that the best results in reducing human cases are achieved by reducing the number of positive broiler flocks. With this in mind a revised monitoring programme was introduced in 2001. The revised programme was aimed at primary production to further reduce the number of positive flocks on farms. The Campylobacter Monitoring Programme is largely based on the Swedish Salmonella Control Plan. Both programmes are very heavily focused on farm biosecurity.

The Campylobacter Monitoring Programme has been very successful and has reduced the level of positive flocks from 60% in 1989 to 8.8% in 2013. The EFSA baseline study in 2008 indicated that the EU average for positive flocks is around 75%.

The Campylobacter Monitoring Programme (in Sweden) has been very successful and has reduced the level of positive flocks from 60% in 1989 to 8.8% in 2013

Campylobacter-positive flocks are mainly detected during late summer and in autumn. The results from the Swedish Monitoring Programme indicate that the prevalence of Campylobacter in flocks is largely dependent on the standard of the housing and the level of biosecurity on farms. Campylobacter is also more commonly found in broiler flocks reared in the southern parts of Sweden. This also happens to be where the highest density of broiler farms in Sweden is located.

4.5. New Zealand

The Campylobacter Performance Target, or CPT, was introduced by the Ministry of Primary Industry, or MPI, to put the responsibility on the poultry industry to implement and achieve set targets. This came about following reports identifying poultry as the biggest source of food poisoning in NZ. Since 2007 there has been a mandatory testing system in all primary processing plants in NZ, with the full implementation of the CPT from 2008. The pressure was on both processing and farms to reduce the levels of Campylobacter. The work and testing the industry has carried out over the past few years has found the biggest reduction occurred in the processing area, which is why today the main focus now is in the poultry processing plants. By putting a high level of focus on the processing plants all the controls can be managed under one roof. This focuses resources on 7 processing plants rather than trying to maintain controls across the 180 farms that supply the processing plants in NZ. By having effective controls in primary processing, the industry has seen that the level of Campylobacter can be reduced significantly.

By having effective controls in primary processing, the (NZ) industry has seen that the level of Campylobacter can be reduced significantly.

4.5.1. Testing in processing plants

Mandatory testing in processing plants was introduced in 2007 and is centered on an outcome-based result. The initial standard was proposed by the industry as an alternative to a mandated intervention but the MPI modified this proposal and then mandated it. The MPI set the standard the industry needs to achieve and it is up to the industry to make sure that they implement and manage the interventions to achieve the CPT targets. It was decided that the whole-carcass rinse would be used as the standard testing method because the United States Department of Agriculture used this method and it thus allowed NZ to compare its results with those of the USA.

The whole-carcass rinse test involves placing a random carcass in a bag with 400 ml of solution and shaking the bag for 2 minutes while massaging the surface. The fluid is then poured into a sealed container and sent to the laboratory for testing. All the results are enumerated so that the level of Campylobacter in each sample can be determined. A Campylobacter level of 3.78 log or over is counted as positive, and having more than 29 of the 45 samples with detectable Campylobacter is also counted as positive. The limit of detection is 2.3 log per carcass.

> NOTE: *Scientists often refer to logs in microbiology since the numbers get so huge – it is so much easier saying log 9 than 1000,000,000 or a thousand million! And also when plotting growth curves scientists use logs due to the 'log' phase of growth when the numbers are doubling at exponential rates - the Wikipedia link explains it well:* *https://en.wikipedia.org/wiki/Bacterial_growth*

The number of samples taken by each plant depends on the number of chickens a plant processes each year. Plants processing less than 1 million birds per year are required to take 3 random samples each week. Plants processing more than 1 million birds per year have to take 3 samples per day. By

Figure 3: An operative performing a whole-carcass rinse.

taking 3 samples each day over 5 processing days there will be 15 samples taken per week. There is then a 3-week rolling window in which the total number of positive samples out of the 45 taken is monitored. The idea behind the 3 week rolling window is to give companies the opportunity to rectify problem areas within the 3 weeks. Should any plant exceed 7 out of 45 positives, or more than 29 out of 45 detected samples in any 3 week period, it would be classed as a non-conformance and triggers an internal investigation. The company will look at the supply farms and the processing plant to ensure that every intervention is operating correctly. Should there be subsequent weeks of having more than 7 out of 45 positives, or 29 detected in the 3-week window, the level of importance will be raised.

All test results are added to the National Microbial Database which provides the industry, researchers and MPI with the data they need to assess the effectiveness of the interventions. This also gives them the data to analyse longer term trends. The two main areas identified where Campylobacter levels can be reduced in processing are in the processing equipment and the spin chill operations.

The industry has a Campylobacter response team who will visit a plant where an issue has been identified. This team is made up of key people from the different poultry companies and the aim is to get a fresh set of eyes to help identify areas that could lead to contamination. The presence of the industry response team is indicative of how the companies will help each other to ensure the industry meets their targets. Should the response team fail to reduce the level of Campylobacter the MPI response team will get involved and this could lead to all poultry meat being frozen or, in the worst case, for the plant to be closed until the problem areas have been corrected.

The introduction of the CPT has led to the number of human cases reducing from about 450 to 150 cases per 100,000 people in the population. Despite this, NZ is still the country with the second highest number of human cases. At the time of my visit the Ministry of Primary Industries was in the process of raising the bar and making it harder to meet the targets in order to further reduce the number of people getting ill each year.

The two main areas identified where Campylobacter levels can be reduced in processing are in the processing equipment and the spin chill operations.

4.6. USA

The Food Safety and Inspection Service, or FSIS, is the USDA department that implements and monitors the Campylobacter Performance Standards in the USA. According to the FSIS website the Salmonella and Campylobacter Performance Standards apply to processing plants' overall process

control, not to individual products. Products are not tested to measure their disposition, but rather to measure the effectiveness of the slaughter and grinding process in limiting contamination. Campylobacter Performance Standards are taken in sets and the results of an entire set are used to determine if a processing plant is meeting the Performance Standard *(FSIS, 2014).* The current Performance Standards have been in place since January 2011.

Sampling is carried out by FSIS staff in all US processing plants and samples are collected after the carcasses exit the immersion chillers. The set is started unannounced so processing plants have to ensure their interventions are working and effective every day of the year.

Testing for Campylobacter

When a set has started, a random carcass is selected and tested for the presence of Campylobacter. This process is repeated daily for 51 consecutive days. Carcasses are collected and, as in NZ, samples are obtained by placing a random carcass in a bag and rinsing the carcass with 400ml of solution. 100ml of the fluid is poured into a sealed container and sent to the laboratory for testing. Testing is carried out to determine if any Campylobacter is present in the sample. Unlike NZ, where only levels greater than 2.3 log are counted as positive, *any* Campylobacter found in the sample counts as positive. To achieve the Performance Standard for whole carcasses, a plant has to have less than 8 positive samples out of 51. If a plant has 8 or more positive samples they fail the Performance Standard.

The results:

Sets and Categories

Depending on the number of samples that test positive in the two most recent sets, the processing plant falls into one of 3 categories.

- For whole carcasses, a processing plant is in **Category 1** if no more than 4 out of 51 samples test positive i.e. less than 50% of the Performance Standard in both sets.
- A processing plant is in **Category 2** if between 5 and 7 samples test positive i.e. between 50% and the Performance Standard in both sets.
    - *If a plant fails to meet Category 1 standard for only one of the two sets the plant falls into **Category 2T**. This allows the plant to return to Category 1 standard should the next set meet the criteria.*
- A processing plant is in **Category 3** if more than 8 samples test positive i.e. more than the Performance Standard in one out of the two most recent sets.

The aim is for all a company's processing plants to fall into Category 1. Companies have to inform their customers should they move out of Category 1, which could lead to orders being cancelled from that plant. Occasionally there can be several months between sets so if a plant has slipped back to Category 2 it could cause the company a problem for a significant amount of time.

Chicken Campylobacter Performance Standards

	Category 1	Category 2	Category 3
Number of positive samples out of 51	≤4	5 to 7	≥8

Recently, FSIS posted the third quarterly progress report for calendar year 2014, stating that 87.7% of broiler processing plants were in Category 1, 4.7% in 2T, 4.1% in 2, and 3.5% in Category 3.

Changes to the Performance Standards

The USDA Performance Standards changed in March 2015. Instead of taking a sample on 51 consecutive days a random sample is taken every day throughout the year. The results are assessed on a rolling window so that the results will always be measured against the last 51 samples. There are different targets to meet depending on the type of poultry meat that is produced. In the past the main focus was on reducing the number of pathogens on whole carcasses. The focus has changed to include portions and ground poultry meat *(FSIS, 2015).* 4 pounds (lbs) of parts and 325 grams of comminuted product are to be collected and tested for Campylobacter and Salmonella. Since 4 lbs of chicken wings will come from more than 20 different birds, the Performance Standards will be very difficult to meet.

As with whole carcasses, the number of positive samples of portions and ground chicken that test positive in the set puts the processing plant in to one of 3 categories:

Number of positive samples out of 52	Category 1	Category 2	Category 3
Whole carcasses	≤4	5 to 7	≥8
Parts	≤2	3	≥ 4
Comminute chicken	≤1		

While I was there, another proposed change was the publication of category results of individual plants on the FSIS website from July 2015.

4.7. UK situation

I met Dr Kevin Hargin from the FSA to discuss their strategy on reducing the number of people in the UK contracting Campylobacter. Rather than implement a mandatory testing and monitoring programme the FSA has decided to adopt a "Name and Shame" strategy. This involves testing random chicken samples off the supermarket shelf for the presence and level of Campylobacter. The results of the survey are published quarterly and are designed to force retailers to get their poultry suppliers to improve their performance or face negative publicity in the media. Around 80% of fresh chicken in the UK is sold through retailers so one can argue that this is an effective way to put pressure on the largest sector of the poultry supply chain. This has had the desired effect and retailers have involved all their suppliers in trialling interventions in their individual operations. All these interventions are voluntary and have shown various degrees of success in reducing the level of Campylobacter on carcasses.

My reservation about this approach is that the FSA has turned an industry problem into a retailer problem.

My reservation about this approach is that the FSA has turned an industry problem into a retailer problem. It has given retailers with good results a means of gaining a competitive advantage over competitors with poorer results. Retailers are starting to move orders between suppliers to try to

capture good publicity when the quarterly results are published. I do not believe that this is an effective strategy if an overall reduction of Campylobacter in chicken meat produced in the UK is to be achieved.

During my travels I discussed the FSA strategy with most of the people I visited and none of them thought that it was the correct approach for the UK to take. Roy Biggs, whom I visited in New Zealand, told me that: "*I can't believe that FSA are planning to name the supermarkets that have bad Campy results on their chicken – this smacks of desperation due to a failed strategy*!" Roy did not see how the FSA can claim to be serious about reducing the number of people contracting Campylobacter when they have not introduced a mandatory Campylobacter monitoring programme.

4.8. Summary

All the countries I visited have a Campylobacter Monitoring Programme in place. They have used this to measure each year how many Campylobacter-positive flocks they have, and how effective their interventions are. They have all agreed that this has helped them focus on reducing the amount of Campylobacter entering the food chain. They also agree that a mandatory monitoring programme has forced them to make improvements throughout the supply chain in order to meeting the set targets.

I firmly believe there is an urgent need for the FSA to introduce a mandatory programme in the UK. This will force all broiler producers to test their flocks and understand how seriously high the levels are of Campylobacter entering the food chain. As I have noted, most of the monitoring programmes have been adapted over time. A UK programme can benefit from the findings of other countries that have monitoring programmes, and can be adapted - according to its findings - within the UK poultry industry. I agree with Peter Drucker that "What gets measured, gets managed".

I firmly believe there is an urgent need for the FSA to introduce a mandatory programme in the UK.

Chapter 5. Thinning of broiler sheds and stocking density

Thinning is a process where a part of the bird population is removed so the remaining birds can utilise the space to achieve heavier body weight. Thinning is carried out for commercial reasons to allow more kilograms of meat to be reared on the same space without exceeding the maximum permitted stocking density. The single biggest problem with thinning is that every biosecurity measure is compromised the moment the doors are opened to let catching crews, forklift and catching modules into the sheds, and generally most broilers that stay behind in the shed contract Campylobacter within 2 or 3 days. Tests have shown that the levels are generally very high after thinning.

The single biggest problem with thinning is that every biosecurity measure is compromised the moment the doors are opened to let catching crews, forklift and catching modules into the sheds

There is still some debate as to whether the remaining birds contract the bacteria because it was introduced into the house on people and equipment; or if the stress of thinning causes some birds to shed the bacteria in high numbers. I believe that catching equipment is in fact the source of the bacteria. Catching equipment is cleaned but not sterilised and therefore bacteria are constantly being circulated between the processing plant and the different farms.

The countries I visited all have different approaches to thinning. The Scandinavian countries do not thin broilers due to the risk of infecting the remaining birds in the flock with Campylobacter. The USA do not thin broiler sheds due to the disease risk this poses to the birds. New Zealand thins sheds up to 3 times and relies on antimicrobial treatments in the plants to reduce the level of Campylobacter.

5.1. Norway

The majority of broiler flocks in Norway are not thinned.

At the time of my visit, Norway was carrying out a small amount of thinning as a particular customer wanted larger birds. Due to issues with high levels of Campylobacter in the thinned birds the company negotiated a price deal with the customer whereby the birds can be reared without the need to be thinned.

The standard stocking density for broilers is 36kg/m^2.

5.2. Iceland

The authorities in Iceland introduced a freezing policy for all Campylobacter-positive flocks in 2000. It was then up to the industry to demonstrate that flocks are Campylobacter-negative and can be sold fresh. The industry started testing each broiler flock on farm. Results indicated that around 40%

of broiler flocks were infected with Campylobacter each year. Thinning of broiler houses was the most obvious problem as most flocks tested negative before thin, and positive at final depopulation. At this point several of the larger broiler sheds were thinned routinely. The conclusion was that it is not possible to maintain biosecurity once equipment and catchers enter the poultry house and the practice of thinning was stopped permanently. After thinning was stopped, the number of Campylobacter-positive flocks reduced from 40% to around 15% per year.

After thinning was stopped (in Iceland), the number of Campylobacter-positive flocks reduced from 40% to around 15% per year.

The maximum stocking density for broilers is 39kg/m^2.

5.3. Denmark

Less than 20% of broiler flocks are thinned each year. Denmark has phased out thinning for the same reason as other Scandinavian countries. The maximum stocking density in Denmark is 42kg/m^2 which offsets part of the cost of not thinning broiler sheds. Denmark relies very heavily on exports so uses this as a means to keep the cost of production low and make their product competitive on the world market.

5.4. Sweden

The majority of broiler flocks in Sweden are not thinned.

At the time of my visit a company in the north of Sweden recently started doing a small amount of thinning. This was a trial to assess the financial impact on the business. A proportion of the birds are caught at 30 days and the rest will be caught at 38 days. At the time of my visit there had not been an increase in the level of Campylobacter in these flocks. It was assumed that due to the colder weather in the north, the risk of Campylobacter is much lower than in the south where it is warmer. Since my visit, however, the company had higher levels during the winter which forced them to abandon the practice.

The maximum stocking density for broilers is 36kg/m^2.

5.5. New Zealand

Broiler flocks are often thinned up to three times in NZ. There is a voluntary testing programme to test for the presence of Campylobacter in the first birds taken into the processing plant. I suspect that the level of Campylobacter in thinned broilers entering the processing plants is very high and that there is a reliance on the antimicrobials to reduce this level. Levels are likely to be especially high in birds that have been thinned three times and may contribute to NZ having the second highest number of human cases of Campylobacter in the world.

The maximum stocking density for broilers is 38kg/m^2.

5.6. USA

Broiler flocks are not routinely thinned in the USA. Thinning was phased out a number of years ago as the US poultry industry had a lot of issues with the spreading of diseases during thinning. Biosecurity levels on US poultry farms are not as robust as those on farms in the UK, and transport crates do not get washed. This increases the risk of cross contamination. Not routinely thinning flocks helps reduce the risk of spreading disease.

There is no legislation to regulate the maximum stocking density for broilers. For this reason the stocking densities on US broiler farms are higher than in the UK.

5.7. UK situation

Most broiler flocks in the UK get thinned at least once but it can be as many as 4 times. The maximum permitted stocking density under the Red Tractor Farm Assurance Scheme is 38kg/m^2.This allows for 38 kg of meat to be produced on each m^2 of floor space each flock. A flock that has been thinned once increases the meat produced per m^2 to 47kg per flock, which is an annual increase of 67.5 kg per m^2 (based on a 7 week flock cycle and depends on the weight profile the birds are reared to).

There is no doubt that by removing thinning the cost of producing chicken in the UK will increase. This will make imported chicken more attractive to the British market, which will undermine the UK poultry industry. Without Government intervention to protect the UK poultry industry against cheap imports, the UK industry will have to rely on the retailers' commitment to selling UK chicken in their stores. The industry is reluctant to explore the benefits of no-thinning because of the extra cost this will add to producing chicken.

At the time of writing this report, 2 Sisters Food Group is halfway through a year-long trial in which none of the flocks supplying one particular processing plant are thinned. Although the trial is not yet completed, the number of positive flocks are only half that of the control farms. The cost of no-thinning is estimated at around £0.05p per kilogram. If the trial is successful, the no-thinning results could show that the levels in processing plants can be kept below the FSA target and there will be a good case to have no-thinning adopted more widely.

If the UK broiler industry were to stop thinning, where would all the additional birds be reared? I believe that there are five factors that will help to mitigate the shortfall:

1. **Growth rate will increase.** The process of thinning has a temporary negative effect on the growth rate of the remaining birds (those left in the shed after thinning). After thinning, broilers will take 2 or 3 days before they are growing at the same rate compared to that prior to thinning. The Icelandic industry has shown that, with no-thinning, the average growth rate of broilers is higher than in thinned flocks. This will ensure more flocks are reared on the same farm each year.
2. **Age at which we slaughter broilers can be reduced.** This will not only allow us to rear more flocks on the same area each year but also reduce the number of Campylobacter-positive flocks each year. This is discussed in more depth in chapter 6.

3. **Mortality will reduce.** The Icelandic industry has shown that mortality in non-thinned flocks is lower than thinned flocks. This is more than likely due to lower stress levels in no-thinning systems. This ensures more birds are available to be processed and sold within each flock.
4. **Stocking density should be reviewed.** Under Red Tractor Farm Assurance, broiler farms are not allowed to exceed 38kg of weight per m^2. European legislation states that farms can stock to 42kg/m^2 provided defined welfare outcomes are met. I firmly believe that we should increase the permitted stocking density for broilers reared in no-thinning systems.
5. **Broiler genetics are improving every year.** Broilers grow faster each year and use less resource to achieve the desired weight. In the next decade I predict that broilers will be ready for processing at 28 days which will increase the number of flocks reared on farms each year.

5.7.1. Welfare at thinning

Based on welfare issues alone there is a big argument that thinning should be stopped.

To ensure that birds do not go into the processing plant with feed in their intestines, feed is removed from the birds prior to catching to allow them time to digest feed already consumed. To allow access into the sheds, feeders and drinkers are raised for the duration of catching. While the catching is in progress the birds that are not actually removed are still subjected to the noise both of forklifts and of people catching and loading birds. Despite the fact that most catching takes place in the dark, it is likely that the process of thinning may lead to some level of stress.

Figure 4: Early morning catching on a Norwegian broiler farm

Chapter 6. Age of birds at processing

It is a known fact that when a broiler flock becomes infected with Campylobacter the whole population will be infected within 2 to 7 days. (*Shaker et al, 1990).* It is also a fact that the older the birds, the more likely they are to test positive and have a higher level of Campylobacter. The younger the age at which the birds are processed, the less time there is for the birds to become infected.

Sigurborg Daðadóttir, Chief Veterinary Officer for Iceland explained to me that the industry in Iceland has actively reduced the slaughter age of their broilers in order to reduce the levels of Campylobacter in birds entering the processing plants. This was effected by changing the breed of birds reared to Ross 308, and also by stopping the thinning of broiler sheds. In the 1990s the age of the broilers produced was around 38 days whereas today the age is between 30 and 32 days. This has had a big effect in reducing the summer peak in the number of flocks with Campylobacter. In chapter 5 I discussed the effect of the increased growth rate of flocks that have not been thinned. I believe that if we stop thinning broiler sheds the birds will grow faster and thus they will be able to be processed at a younger age, reducing the number of Campylobacter-positive flocks.

Figure 5: A broiler shed in Iceland. These broilers are 32 days old and ready for processing

Reference:

Shanker, S. Lee, A. and Sorrell, T. C. (1990) Horizontal transmission of Campylobacter jejuni amongst broiler chicks: experimental studies. Epidemiology and Infection ***104*** *101 – 110.*

Chapter 7. Biosecurity

Biosecurity is the overall term used for the processes followed to keep diseases out of broiler sheds. Good biosecurity is not only essential in keeping Campylobacter out of our broiler sheds but also pathogens such as Salmonella, Avian Influenza and Newcastle Disease.

Stopping bacteria entering the house during the life of the birds is the first step. The second step is to have a thorough cleaning and disinfection programme between flocks and the third step is to ensure that nothing is brought into the house after disinfection has been applied.

In my opinion the UK industry has made huge strides in improving biosecurity over the past decade. I am sure that the focus on Campylobacter reduction and the constant threat of Avian Influenza have helped farmers realise that we must have the highest possible level of biosecurity to eliminate the risk of these diseases. I think we still have quite a long way to go to get the UK poultry industry to the level of Scandinavian broiler farms but, if we start to adopt these increased biosecurity measures in new facilities, we will begin moving in the right direction.

A large part of improving biosecurity comes down to education. If people understand what they need to do what at the various interventions, and why, there is a much better chance of them adhering to all the procedures at all times. One of the methods Sigurborg Daðadóttir, Chief Veterinary Officer for Iceland, uses to help farmers remember the importance of good bio-security is to compare a broiler house to an operating theatre. "*Consider yourself contaminated and that you need to go through a series of processes to ensure you are clean enough to operate in the house.*"

Figure 6: Double barrier system principles

When I visited the poultry industry in Norway I came across the poster above, which was displayed in each of the broiler houses I visited. It illustrates a double barrier system which is standard practice

on all farms. The biosecurity principles in Norway, Sweden and Iceland were very similar and I believe this is what we as a UK industry should aspire to.

7.1. Double barrier system

Each control room is fitted with 2 barriers that have to be crossed before entering the poultry houses. The entry room is divided into three areas: a “dirty” area, a “semi-clean” area and a “clean area”. Each area has a separate drain which allows the separate areas to be washed without cross-contaminating the other areas.

7.1.1. Dirty area

Overcoats and shoes are left here as soon as you step into the area designated the dirty area.

7.1.2. Semi-clean area

You then step into the semi-clean area where you proceed to wash your hands. All semi-clean areas are required to have a sink with hot and cold water, soap, hand sanitiser and paper towels. In Iceland, the semi-clean areas are also equipped with insect electrocutors to kill flies and any other insects before they have an opportunity to enter the broiler houses.

7.1.3. Clean area

Once hands are washed, dried and sanitised you step over into the clean area where shed-specific boots are put on. It is here that hairnets, disposable gloves and shed-specific overcoats are put on before stepping into the poultry house.

Upon exiting the broiler house the shed-specific boots are washed, disinfected and stored upside down after each use to ensure that no Campylobacter survives on the boots. Every clean area has a shed-specific toolbox so there is no need to move tools between sheds. All equipment used in the sheds is shed-specific. If hand tools are moved between sheds they must be washed and sanitised.

The Swedish Poultry Meat Association believes that if the door to the bird area is not in a straight line with the initial entry point people are more likely to follow the correct

Figure 7: Farmer Lars Andersson ensures we follow the correct procedures as we enter his broiler house.

procedures. I can see the logic of this as it forces you to stop and change direction and you are therefore more likely to remember to adhere to the correct procedures before walking through the semi-clean area to the birds.

In Sweden I visited a farm that has a loading bay between the semi-clean and the clean area. The loading bay was built so that the chick delivery vehicles can be reversed into the loading bay and chick trolleys can be wheeled directly into the sheds. The loading bay also acts as the exit point for dead birds and also for access during catching. This way, no dead birds ever enter the semi-clean area. The loading bay also acted as a laundry room where all the shed clothing is left and washed. This stops any clothing being moved between sheds.

7.2. Hygiene on farms

A clean farm is fundamental to a good broiler flock. If a farm is clean, the chicks are exposed to fewer bacteria and tend to have a better start in life. Clean farms that are allowed to dry completely are essential if no Campylobacter is to survive from one flock to the next.

Both of the companies that I visited in Iceland operate a no-wood policy inside their broiler houses. Wood is a permeable surface and cannot be disinfected. A very large percentage of UK broiler houses are of wooden construction and it will take decades to have an industry where there is no wood inside broiler sheds.

7.2.1. Cleanout

Broiler farms in Norway, Sweden and Iceland tend to have a one-week turnaround period. This is similar in the UK. As a rule the muck is removed and the sheds are washed as soon as the last flock has left: this is in order to give the sheds as much drying time as possible. Good cleaning and drying of sheds is the most effective means to ensure no pathogens are transferred to the next flock.

In Iceland, broiler sheds are washed with hot water at low pressure. Shaving bales are imported from Sweden and get placed inside the broiler houses before the disinfectant is applied. The team that does the disinfecting turns the bales halfway through the process to ensure that both sides of the bales are disinfected. Once disinfection is completed the sheds are allowed to dry.

To ensure that no machinery enters the house the sheds are set up by hand ready for the next flock. Chick baskets are passed into the shed to ensure that the baskets do not make any contact with the outside floor. In preparation for chick delivery the shaving bales are spread across the floor by hand. I was surprised at how thin the layer of shavings on the floors was compared to what I am used to in the UK. I am sure that, compared to the gas fired heaters in the UK, the dry heating systems in Iceland can remove litter moisture more effectively so that less litter is required in order to keep it in a good condition for the birds.

Iceland has the benefit of having a plentiful supply of cheap geo-thermal hot water so all sheds are equipped with dry heating systems. Heat is delivered through radiators or, in newer sheds, through under-floor heating. Hot water is obtained from a network of pipes that supplies domestic houses and businesses in the Reykjavik area and in other main towns. Where farms are located in more

remote parts the hot water is obtained from boreholes that pump hot water from deep below the surface of the ground.

Figure 8: Shaving bales are disinfected within the house

Figure 9: Underfloor heating allows shed floors to be kept very warm

7.2.2. Water treatment

It is mandatory in Norway and Iceland to treat all borehole and well water with a UV light. This destroys any bacteria in the water and reduces the risk of campylobacter. The downside of the UV light is that it is difficult to clean the inside of the filter as it is hard to get to the area where the bulb shines the light into the pipe.

7.2.3. Disposal of Campylobacter-positive manure

The level of campylobacter in the environment is a key area of concern in Norway. Where litter from positive flocks is spread on land, the level of Campylobacter in the environment will be higher and there is therefore a greater potential for Campylobacter to be reintroduced into subsequent flocks. Chicken manure tends to get stored in muck heaps on the farms. Since the majority of farms are less than 40 ha the muck heaps tend to be near the poultry houses as there is limited space on the farms. Farmers are actively encouraged to store their litter as far away from the poultry houses as possible. The industry is looking into other means of treating litter from positive flocks. Composting and incineration are being investigated as possible means to kill off Campylobacter in the manure.

7.2.4. Disposal of wash water

Another area that has been identified as a possible risk is the dirty water system. When the sheds are washed, the wash water leaves the shed through a drain in the floor. If the contaminated water could find its way back into the house it could contaminate subsequent flocks. Thought needs to be put into where wash water goes and how it is stored.

Wash water stored in open tanks can also encourage flies to the area around the broiler houses. Swedish farmers put a lot of emphasis on pumping water to tanks that are more than 50 meters from the sheds and ensuring that the tanks are fly proof.

7.2.5. Standing water around the sheds

The Swedish Poultry Meat Association actively encourages farmers to improve drainage to avoid standing water around the farms. Campylobacter can survive in water so, by removing water from around the sheds, the risk of having Campylobacter reservoirs is reduced. Farmers are also encouraged to ensure rainwater is piped into drainage systems so roof water is removed. One of the farms I visited did not have concrete around the sheds so that rainwater and snow could seep into the ground.

7.2.6. Following up on Campylobacter-positive flocks

In Norway it is stipulated that, after a positive flock test, an investigation must be carried out by the company owning the birds. There is a standard questionnaire that is completed after every positive flock test. This is to try to identify where the Campylobacter came from and to avoid future contamination. By focusing on the Campylobacter-positive farms, the industry has managed to

reduce the incidences so that today nearly half of infected flocks are located on less than 10% of the farms.

7.3. High risk farms

The Icelandic poultry industry gave each of their farms a risk status. This allowed them to focus their early work on farms that were at the highest risk of contracting Campylobacter. Farms with more than one house were deemed to be a higher risk than farms with only one house. Also, farms that could not be cleared in one phase were classed as high risk.

Iceland has a low population density so farms are generally not near other livestock. Tómas Jónsson, who works as the veterinarian for Matfugl in Iceland, told me about an interesting case that was observed a few years ago. One of the Matfugl farms has a stable next door. In spring it is the practice to move the horses to the highlands where they spend the summer months. The eruption of the Eyjafjallajökull volcano in 2010 meant that the horses could not be moved to the highlands, and in that summer the farm had a significantly higher incidence of Campylobacter than other farms. One theory is that the flies attracted by the horses caused the increased level of Campylobacter. On the other hand Tómas told me about another farm that is next to a dairy and, despite this, the farmer is able to keep the flocks free of Campylobacter.

7.4. Bird- and fly-proofing of sheds

Chickens are omnivores and eat insects and flies when given the opportunity. All the Scandinavian countries I visited are becoming more and more convinced that flies are a key vector for Campylobacter. Sweden and Iceland are leading the way in excluding flies from broiler sheds and are seeing very good results in reducing the number of Campylobacter-positive flocks each year.

All the Scandinavian countries I visited are becoming more and more convinced that flies are a key vector for Campylobacter.

7.4.1. Bird-proofing

In Sweden there is a big focus on keeping wild birds away from the sheds. Keeping feed away from bulk bins stops wild birds from being attracted to the broiler houses. Spikes are installed on the fan chimneys to stop wild birds from sitting on the chimneys. The concern is not just that wild birds will get into the poultry houses but also that bird droppings might fall into the sheds. The chimneys expel warm air so wild birds like sitting on the fan chimneys in cold weather. If spikes cannot be installed, wire netting is put over the fans. Wild birds are also kept off the roofs to avoid droppings that can contain Campylobacter from washing down the roofs. Should any of the contaminated rainwater enter a shed it can act as a carrier for Campylobacter.

Figure 10: Spikes on chimneys stop birds sitting on the chimneys

7.4.2. Covering inlets

All the air inlets in broiler sheds in New Zealand are fitted with bird-proof mesh to stop wild birds entering the poultry houses. The mesh was installed mainly to reduce Salmonella in broiler flocks but it also reduces the risk of wild bids carrying Campylobacter into the sheds.

In Sweden air inlets are also fitted with bird-proof mesh. In addition to this, inlets are fitted with a cover on the outside of the shed to stop light escaping at night. The reason for doing this is to stop flies and insects being attracted to the poultry houses during the night. A large part of the UK industry now has windows installed in broiler houses. The light from these windows will attract a lot of insects during the night which could introduce Campylobacter to the flocks.

7.4.3. Fly netting

Initially, flies were not considered a factor in the spread of Campylobacter in broiler flocks. However, a Danish researcher proved that, in sheds where flies were excluded, the birds did not contract Campylobacter during the summer months. This led to successful trials in Iceland followed by the introduction of fly nets on all high risk farms from 2009. Since then, the level of positive flocks has reduced from around 15% to less than 4%. Although everybody I spoke to was sure that flies played a very important role in spreading Campylobacter, they all agreed that fly nets will only work when all the other interventions are working effectively. Tómas Jónsson from Matfugl's opinion is that *"Flies are not the only problem but* are *part of the problem."*

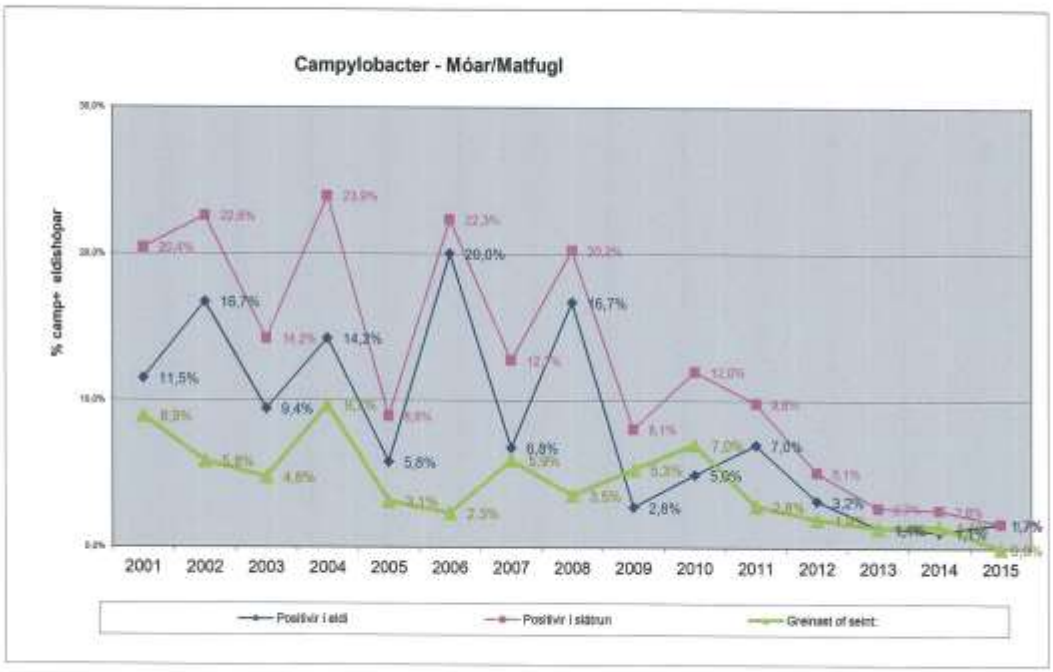

Figure 11: Matfugl data showing the reduction in Campylobacter positive flocks between 2000 and 2015.

Pink line - % positive flocks at processing,
Blue line - % positive flocks on farm,
Green line - % of flocks that turn positive between farm testing and processing testing.

Due to the weather conditions in Iceland, the majority of broiler sheds do not have side inlets – this is to stop the wind blowing straight through the houses. Air is brought into the sheds through inlet fans and is removed with extraction fans. Fly nets are installed on the inlet fans from May to October to stop flies being brought in with the air when the fans are running. Extractor fans are set to run continuously at a low speed to stop any flies entering though the fan shaft when the fan is not running. Where sheds are fitted with side inlets fly nets stay on the outside of the shed throughout the year.

Figure 12: Shed with side inlets which are covered year round to exclude flies

(continued on next page)

Figure 13: Fly netting is installed on fans during summer months

7.4.4. Summary

As part of the Joint Working Group project, fly netting was trialled on broiler sheds in the UK. The results did not show any reduction in the number of broiler flocks that became infected with Campylobacter. The way existing sheds are designed in the UK does not guarantee the exclusion of flies. A large proportion of sheds are equipped with tunnel ventilation to reduce shed temperature during very hot weather. Installing fly netting will undoubtedly restrict the airflow through the sheds which will remove the cooling effect from fast moving air and have a negative impact on the welfare of the birds. Despite the restrictions we have in the UK I believe we should be aware of flies and keep this in mind when designing and building new broiler sheds. Wild birds should be excluded from broiler sheds as a matter of good practice and this can be done relatively easily.

7.5. Condition of broiler houses

Swedish broiler producers have proved that Campylobacter-positive flocks are linked to the condition of the housing. They have demonstrated that older broiler farm units have higher incidences of Campylobacter compared to newer farm units.

A 2009 survey conducted by the National Farmers Union indicated that the average age of a broiler house in the UK is 24 years. Charles Bourns, NFU poultry board chairman, called for the government, the supply chain, and the public to recognise that the industry needs to invest to avoid future shortages of fresh chicken. He also said that it is getting harder for chicken farmers because of complex planning rules, environmental regulations, the loss of tax allowances and diminishing margins (*Farmers Weekly, 2009*).

I believe that our industry needs help to facilitate the renewing of old broiler facilities with newer and more efficient farms. New farms can be cleaned much more effectively which will undoubtedly leave fewer bacteria to re-infect subsequent flocks.

Reference: *Farmers Weekly - Shed survey reveals lack of investment in broiler housing.* Available at: http://www.fwi.co.uk/poultry/shed-survey-reveals-lack-of-investment-in-broiler-housing.htm (*Accessed 8 July 2015*).

Chapter 8. Farmer penalties and incentives

In Norway, Sweden and Denmark processors penalise farmers who supply Campylobacter-positive birds. This takes the form of a reduced liveweight price paid to the farmer. Money is taken off the farmer to help the processor towards the cost of treating the contaminated carcasses and to force farmers to operate the highest level of biosecurity. All the farmers in these countries are contract growers so the processors do not have any direct involvement in the day-to-day running of the farms.

When talking to the farmers in Norway and Sweden it was astounding how much they knew about Campylobacter and how focused they all are on preventing infection. As well as running the risk of paying a penalty, they also all regard acquiring a Campylobacter-positive flock as some form of failure on their part. For this reason, they embrace good biosecurity. This was clear in the way their broiler houses are designed, how contaminated litter and wash water is treated, and how they go about their day-to-day business in the sheds. This shows yet again that education plays a huge role in ensuring everybody knows what Campylobacter is and how flocks get contaminated.

When talking to the farmers in Norway and Sweden it was astounding how much they knew about Campylobacter and how focused they all are on preventing infection.

The Icelandic industry explored paying financial incentives to farmers whose flocks test negative and penalties for those whose flocks test positive. This was eventually stopped as it did not have a noticeable benefit. Flocks where everything was done according to the procedures still became infected. It was also difficult to justify a penalty as nobody could demonstrate how to eradicate the bacteria completely. Both companies I visited in Iceland are completely integrated. This allows them more control over the supply farms and reduces the risk independent farmers would pose to the business.

At the time of writing this report, 2 Sisters Food Group is involved with a year-long trial where financial incentives are paid to farmers whose flocks test negative for Campylobacter. The results of this trial will be very valuable in assessing the effectiveness of paying incentives to farmers and seeing whether this will encourage them to adopt the highest levels of biosecurity.

Chapter 9. Transport and processing controls of Campylobacter

Although my study focused on farm interventions, it is important to highlight a few key areas in the transport and processing of broilers. The stages are all linked and so one cannot look at farm interventions in isolation.

9.1. Transport

The cleanliness of the transport equipment, catchers and vehicles is essential in stopping cross-contamination between the processing plant and broiler farms. After the birds are removed from the transport crates, the crates must be subject to a thorough cleaning process. Crates must be washed thoroughly to remove organic matter which contains pathogens like Campylobacter and Salmonella. Once washed, the crates must be disinfected to ensure that all pathogens are eliminated. Giving the crates adequate drying time is also important in finishing off any Campylobacter not killed by the washing and disinfecting. The operators in many countries have enough crates so each one is only used once per day to give a long drying time.

Returning clean transport crates to the farm relies heavily on the crates coming into the processing plants without lots of organic matter on the frames. If a farm sends in crates with lots of litter, the crate washers get loaded with dirt and the nozzles on the automatic washes get blocked so cleaning is not effective.

Figure 14: Crates are turned upside down to ensure that all areas are thoroughly cleaned

I visited Matfugl's processing plant which is located near Mosfellsbær, a short distance from Reykjavik. The factory is laid out with a viewing corridor along the length of the plant so visitors can see the whole process without entering the plant. I visited the crate wash area and was impressed to see how much time and effort the operators were putting into washing each crate. First the crates were washed in an automatic crate wash before the crates are pressure washed manually with warm water. No area was left unwashed - even the undersides of the crates were washed scrupulously. Afterwards the crates are stacked and allowed to dry before nozzles in the ceiling apply the disinfectant.

I believe that the value of thorough cleaning and disinfection of crates and other equipment is underestimated in the UK.

I believe that the value of thorough cleaning and disinfection of crates and other equipment is underestimated in the UK. In my opinion a mandatory monitoring programme is the only thing

that will force processing plants to clean these thoroughly.

9.2. Processing

The issue with Campylobacter contamination comes down to the way the carcass is handled through the scald tank and mechanical pluckers up to the point where the intestines are removed from the cavity. If any part of the process is not carried out correctly the gut content can be spilled and contaminate machinery and other carcasses.

Figure 15: Clean crates are stacked and allowed to dry. Nozzles in the roof apply disinfection. These can be seen hanging from the ceiling.

When it comes to the question of reducing Campylobacter in processing, Roy Biggs - who works as Food Safety and Quality Assurance Manager for Tegel Foods Ltd in New Zealand - is a font of knowledge. He explained to me how each machine has a role to play in reducing the Campylobacter loading on the carcass. The setting on each of these machines must be correct for the size of carcass being processed. The evisceration process is especially important and if the equipment is not set correctly for the size of the carcass, the gut will break and spill its content. Having good quality evisceration equipment has the single biggest part to play in reducing the level of Campylobacter loading on the end product.

Having good quality evisceration equipment has the single biggest part to play in reducing the level of Campylobacter loading on the end product.

Roy explained to me that the introduction of the mandatory monitoring programme in New Zealand was the driving force for several processing plants to upgrade their evisceration equipment. It also forced the industry to confront Campylobacter together as opposed to each company doing so in isolation. Today, the New Zealand industry has a Campylobacter Response Team made up of various members of the poultry companies. Should a plant struggle to meet the CPT targets, the team will visit the plant and work together to find the cause of the increase in positive samples.

Chapter 10. Conclusions

1. The UK has a world class poultry industry and we should be very proud of it. Despite this, we are still supplying to our consumers an unacceptably high level of poultry meat that tests positive for Campylobacter, and the industry needs to realise that this cannot continue. There are steps that can be taken to reduce the number of Campylobacter-positive flocks on farms but we are not going to make any headway if we do not face the problem with a united front. We need to change what we are doing and the sooner we start, the sooner we will reduce the number of people becoming ill every year from chicken meat consumption.

2. The "Name and Shame" strategy adopted by the FSA is making Campylobacter a retailer problem causing retailers to compete against each other to gain a competitive advantage. Campylobacter is an industry problem and the whole industry needs to work together to provide our consumers with a safer product.

3. Each of the countries I visited has their own unique monitoring programme that has been implemented and adapted over time. A mandatory monitoring and testing programme in the UK will drive improvement across the UK industry. By testing each broiler flock for Campylobacter we will know how many flocks test positive each year and what reduction different interventions give us.

4. Each of the Scandinavian countries I visited identified thinning as a Campylobacter amplifier and has phased out thinning accordingly. In my view, due to the cost involved, the UK industry, retailers and FSA are in denial about the effect no-thinning will have on the number of positive flocks each year. Not only will we have fewer positive flocks each year with no-thinning, we will also be reducing the levels that processing plants have to deal with in the birds being processed. However, if we phase out thinning the cost of producing chicken in the UK will increase and we will need the Government to protect the industry against cheap imports.

5. We must operate the highest level of biosecurity on farms and work towards having a double barrier system. We must do this, not only to reduce Campylobacter infections, but also those of Salmonella and Avian Influenza. We should incorporate the principles of hand wash stations, drains and loading/unloading areas in the design of new sheds. Sweden, Norway and Iceland have demonstrated that this is the most effective way to reduce the level of Campylobacter and Salmonella entering the sheds.

Chapter 11. Recommendations

My recommendations are as follows:

To broiler farmers

Operate the highest level of biosecurity on your farm. Focus on the cleanout of your farm and start each flock in a clean and dry shed. Do not spread Campylobacter-positive litter near the sheds as this could load the environment around the houses with Campylobacter. Ensure wash water is removed from the houses and cannot re-contaminate the shed and the following flock. Avoid uncontrolled access into the poultry house after the shed has been disinfected. Operate a strict barrier system and wear shed-specific boots every time you enter the shed. Shed-specific clothing should be worn wherever possible. Do not share equipment between sheds. Keep birds, flies and other insects out of the sheds.

To processors and retailers

Phase out thinning as soon as possible. Educate and guide your farmers so that they all contribute to the end goal of producing safer chicken. Identify high risk farms and put additional focus into ensuring every intervention is in place and working effectively. Ensure transport crates are clean, disinfected and dry before being sent back to farms. Ensure the latest technology and processing equipment is used and working effectively.

To the Food Standards Agency

I believe your current strategy will not drive real improvement in Campylobacter reduction. The implementation of a mandatory monitoring programme so that all broiler flocks are tested for Campylobacter will be a positive force for change. The results from this monitoring programme can be used to put targets in place which the industry needs to meet in order to actively reduce Campylobacter in the food chain. The maximum permitted stocking density allowed in the UK should be reviewed and higher stocking density in no-thinning systems implemented. The cost of producing chicken will increase with no-thinning so we will need Government intervention to help protect the industry from cheap imported fresh poultry.

To the consumer

You are buying meat from chicken that were reared on farms with some of the highest welfare standards in the world. Please play your part and ensure you cook all products thoroughly and follow FSA guidelines on how to handle fresh poultry meat in the kitchen.

Chapter 12. After my study tour

Being awarded a Nuffield Farming Scholarship means different things to different people. One of the main reasons driving me to apply for a Scholarship was to increase my involvement within the wider poultry industry. I used to find it overwhelming dealing with other key industry people at industry events. Since my Nuffield Farming travels, my confidence has grown and I am now proud to be able to stand up and contribute at industry events.

I was asked to speak about my Nuffield Farming travels at the Northern Broiler Conference in March 2015. It was the first time I have spoken at a conference and I really enjoyed the experience. In July 2015 I was also asked to speak at the ACT On Farm Workshop organised by the National Farmers Union, Food Standards Agency and the British Veterinary Poultry Association. The purpose of this workshop was to bring together producers and industry representatives, to share best practice and review interventions and research that could be implemented on farm and in the rest of the supply chain with the overall aim of reducing levels of Campylobacter in fresh poultry meat. This was a good opportunity to give the industry an overview of how other countries have managed to reduce Campylobacter in the chicken they produce.

I am very fortunate that I work for a company that is progressive and committed to producing poultry to the highest welfare levels. Hook2Sisters is the largest broiler producer in the UK and is committed to reducing Campylobacter on its farms. Together with 2 Sisters Food Group, we are making big improvements to reduce Campylobacter within the group and will soon publish the results of the no-thinning and farmer incentive trials currently being conducted. I am hoping that this will be the first step towards removing the practice of thinning from broiler chicken production in the UK.

During 2014 I was involved with the making of the Campylobacter training programme that 2 Sisters put together for all their farmer suppliers. The interactive training programme was very well received by all our farmers and also won the Pig and Poultry Marketing Awards' Training Initiative of the Year 2014 Award.

In June 2015 Hook2Sisters opened one of its farms to the public as part of Open Farm Sunday and I was instrumental in the organisation of Hook2Sisters' participation in the event. It was the first time that the company has participated in this event and it was a great success and we welcomed 220 members of the public onto the farm.

Earlier this year I was invited to join the British Poultry Council's Chicken Growers' Committee and I am confident that my involvement on this committee will help me to remain an active player within the poultry industry.

I am working towards setting up a partnership between Hook2Sisters and Writtle College. My aim is for poultry to become an integral part of the agriculture course offered at Writtle College. If I can help set up industry links between the college and Hook2Sisters I am hopeful that it will encourage more students into the exciting and challenging world of poultry.

Chapter 13. Executive Summary

Campylobacter is the most common cause of food poisoning in the UK. It is estimated that one in every 100 people in this country contracts the bacterial infection each year, with the source in the vast majority of cases attributed to chicken meat. For a long time the UK poultry industry has been accused of not taking the issue seriously, which led the Food Standard Agency to put Campylobacter at the top of their priorities. The increased pressure has forced the industry to start exploring interventions that can help reduce the level in each stage of the supply chain. I became involved with the industry's Joint Working Group project to set up model farms to see if, by adhering to the highest level of biosecurity, we could reduce the level of Campylobacter in the birds produced at these sites. My involvements with this project led me to apply for a Nuffield Farming Scholarship in order to research more widely how to reduce Campylobacter in the UK food chain.

The primary goal of my report was to see if there are farm interventions used in other parts of the world that can help us meet the targets set by the Food Standards Agency. I visited broiler producers, processors and Government bodies in New Zealand, Denmark, Sweden, Norway, USA and Iceland to research what strategies they used to reduce the number of Campylobacter-positive broiler flocks. Research has shown that reducing the number of positive flocks on farm leads to lower levels of Campylobacter infection entering the food chain and ultimately to less people contracting the bacteria. All of the countries I visited have targets to meet and through the joint working ventures within the industry they have reduced the numbers of people becoming ill with Campylobacter each year. New Zealand has managed to reduce the number of human cases by up to two thirds since implementing their interventions.

My research has narrowed down four key interventions that can be implemented on farm to successfully reduce the number of Campylobacter-positive flocks. A mandatory testing and monitoring programme would drive improvement throughout the supply chain. It would give us the data to understand how widespread the problem is and how effective interventions are. Phasing out the thinning of broiler flocks will reduce the number of positive flocks by up to two thirds. Improving farm biosecurity will help stop not only Campylobacter from entering the poultry houses, but other pathogens such as Salmonella and Avian Influenza as well. Reducing the age at which broiler flocks are processed will further reduce infection on farm as there is less time for the bacteria to spread through the flock. In addition to this, the cleanliness of catching equipment is essential in stopping the cross-contamination between processing plants and farms.

Werner Strydom

Chapter 14. Acknowledgements and Thanks

I would like to thank the Nuffield Farming Scholarship Trust for bringing the biennial Poultry Meat Award forward by a year to allow me to embark on what has been a life-changing journey. It has allowed me to develop my way of thinking and to challenge my preconceptions. Finding myself in situations outside my usual comfort zone has built my character more than I could ever have imagined possible.

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There are so many great people who played a role during my Scholarship. It is absolutely true that one of the most rewarding parts of a Nuffield Farming Scholarship is the remarkable people you come in to contact with. Heartfelt thanks to all of you.

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