

A Microbiological survey of *Campylobacter* contamination in fresh whole UK-produced chilled chickens at retail sale – interim report to cover Quarters 1 - 3

Background to the survey

Foodborne *Campylobacter* is estimated to make more than 280,000 people ill each year in the UK and is the biggest cause of food poisoning. An EFSA Opinion¹ stated that up to 80% of cases can be attributed to raw poultry meat and a tenfold decrease in the exposure levels from this source is likely to reduce the number of human *Campylobacter* cases by between 50 to 90% across all Member States.

The Food Standards Agency (FSA) has set up a joint target with industry to reduce *Campylobacter* in chicken. The target is focussed on a level of 1000 colony forming units per gram (cfu/g), or above. It is thought that chickens with this level of *Campylobacter* contamination are the most likely to infect consumers. The joint FSA-industry target is to reduce the prevalence of these most contaminated chickens (greater than 1000 cfu/g) to below 10% at the end of the slaughter process, by the end of 2015.

This UK-wide survey was established to review the levels of *Campylobacter* on fresh whole retail chickens and their packaging. Testing began in February 2014 and will end in February 2015. The survey aims to test 4,000 samples of whole, UK-produced, fresh chicken. The samples are distributed evenly throughout the year and throughout the UK (in proportion to population size). Retailers are sampled in proportion to market share, according to available data. Free-range and organic chickens are also sampled in proportion.

More detail on methodological issues, including key features of laboratory and statistical sampling, design and analysis, are contained in an annex.

Results

Aggregated results

All results are presented cumulatively over the 9 months of the survey thus far (mid-February to mid-November 2014). It is unwise to interpret trends until at least one full annual cycle has been completed. In the next report, scheduled for May, a month-by-month summary of results will be presented.

¹ Scientific Opinion on *Campylobacter* in broiler meat production: control options and performance objectives and/or targets at different stages of the food chain: <http://www.efsa.europa.eu/en/efsajournal/doc/2105.pdf>

Table 1 shows the cumulative results to date, by separate bands of contamination, found on chicken skin. The lowest band (<10 cfu/g) means that the level of Campylobacter is so low that tests cannot detect it. Where Campylobacter has been detected, the results have been grouped into the following categories based on the number of colony forming units per gram: 10-99 cfu/g; 100-1000 cfu/g and >1000 cfu/g. The highest band (>1000 cfu/g) is the primary focus of attention. The table also shows the upper and lower bounds of the 95% confidence intervals around each prevalence estimate. These provide bounds between which there is a 95% probability that the true prevalence lies.

Just under 19% of the chickens tested were found to contain Campylobacter at a level above 1000 cfu/g. Just under 73% were positive for Campylobacter at any level (i.e. were found to contain Campylobacter at a level above the detectable limit of 10 cfu/g).

Table 1: Prevalence of Campylobacter (cfu/g), for different banded levels, in chicken skin samples (with 95% confidence intervals in brackets).

Chicken Skin	cfu/g			
	<10	10-99	100-1000	>1000
Weighted² % (95% confidence interval)	27.1 (25.5 – 28.6)	22.7 (21.2 – 24.1)	31.4 (29.7 – 33.0)	18.9 (17.5 – 20.3)
No. samples	807	701	970	583

Table 2 shows the cumulative results to date, by separate bands of contamination, found on the packaging of the chickens. The presence of Campylobacter on the outer packaging of chicken packs is a concern as consumers would not expect products to be contaminated on the outside and specific instructions may not be provided with regard to the safe handling of such packaging before opening. The 95% confidence intervals are also provided for these results (shown in brackets in the table).

Just under 7% of the samples were positive for Campylobacter on the outer packaging (i.e. contained Campylobacter at a level above the detectable limit of 10 cfu/g). For 3 out of the 3052 samples tested the level on the outer packaging was found to be above 1000 cfu/g.

² Results are weighted to correct for differences in the number of samples taken per quarter.

Table 2: Prevalence of Campylobacter (cfu/swab) for different banded levels, in samples of chicken packaging (with 95% confidence intervals in brackets).

Chicken Packaging	cfu/swab			
	<10	10-99	100-1000	>1000
Weighted ² % (95% confidence interval)	93.2 (92.3 – 94.1)	5.3 (4.5 – 6.0)	1.4 (1.0 – 1.9)	0.1 (0.0 – 0.2)
No. samples	2841	164	44	3

Results by retailer

Table 3 presents a summary of key cumulative Q1-Q3 results, broken down by retailer. The results of the skin samples are presented in two ways: (a) the proportion of chickens with any level of Campylobacter (including >1000 cfu/g); (b) the proportion >1000 cfu/g. The results for the packaging samples are given as one result; any level of Campylobacter.

The numbers of samples taken for each retailer is proportional to their market share. Retailers whose market share was below a certain cut-off have been grouped within the “other” category. No conclusions can be drawn about the individual retailers within this category. The market share data, on which these judgements were made, are described in the methodological annex.

The 95% confidence intervals reflect the uncertainty in the results: they provide a lower and upper bound that has a 95% probability of containing the true prevalence. A key factor in the width of this interval is the sample size. Those retailers with a relatively low market share have a low sample size and correspondingly wide confidence intervals. It is particularly important to take note of the confidence intervals when comparing results across retailers, due to the differences in sample sizes. Where the upper and lower bounds overlap between retailers it suggests caution in drawing conclusions about which may have a lower or higher proportion of chickens with Campylobacter.

Table 3: Results for Q1-Q3 broken down by retailer for: overall prevalence of Campylobacter on chickens sampled; prevalence of chickens with levels of over 1000 cfu/g of Campylobacter; and the prevalence of Campylobacter on the outside of the chicken packaging. All results are weighted for any uneven sampling of retailers across quarters.

Retailer	No. of samples	% skin samples positive for Campylobacter (95% confidence interval)	% skin samples >1000 cfu/g Campylobacter (95% confidence interval)	% pack samples positive for Campylobacter (95% confidence interval)
Asda	491	78.9 (75.2 – 82.4)	31.1 (27.0 – 35.2)	13.0 (10.1 – 16.1)
Co-op	274	75.6 (70.2 – 80.6)	16.4 (12.3 – 20.9)	4.4 (2.1 – 7.0)
M&S	103	72.2 (63.0 – 80.7)	20.7 (13.0 – 29.1)	3.8 (0.8 – 8.1)
Morrison's	271	76.2 (71.4 – 80.9)	22.9 (18.0 – 28.0)	13.3 (9.5 – 17.4)
Sainsbury's	451	69.6 (65.4 – 73.7)	14.3 (11.2 – 17.6)	4.0 (2.3 – 6.0)
Tesco	925	68.2 (65.3 – 71.1)	12.3 (10.2 – 14.4)	4.1 (2.9 – 5.4)
Waitrose	96	71.7 (62.1 – 80.5)	15.6 (8.5 – 23.7)	6.2 (2.1 – 11.7)
Others³	450	76.9 (72.9 – 80.7)	23.2 (19.4 – 27.2)	6.8 (4.6 – 9.2)
Total	3061	72.9 (71.4 – 74.5)	18.9 (17.5 – 20.3)	6.8 (5.9 – 7.7)

Figure 1 presents the retailers' results for levels of Campylobacter >1000 cfu/g in a graphical way. The vertical error bars show the 95% confidence intervals for each retailer. The Industry average for levels >1000 cfu/g are shown by the horizontal lines. The 95% confidence intervals of these prevalence estimates are given by the additional horizontal lines. Where the error bars for the retailers overlap caution is required when drawing conclusions about any differences between retailers.

Each retailer's result has been compared to the average of all other retailers. Asda was the only named retailer to have a statistically significantly higher proportion of chickens with Campylobacter levels at >1000 cfu/g compared to the average of all other retailers ($p < 0.001$). Tesco was the only named retailer to have a statistically significantly lower proportion than the average of the others ($p < 0.001$).

³ The 'Others' category includes supermarkets where the market share was deemed small using the 2010 Kantar data: e.g. Lidl, Aldi, Iceland, plus convenience stores, independents, butchers etc.

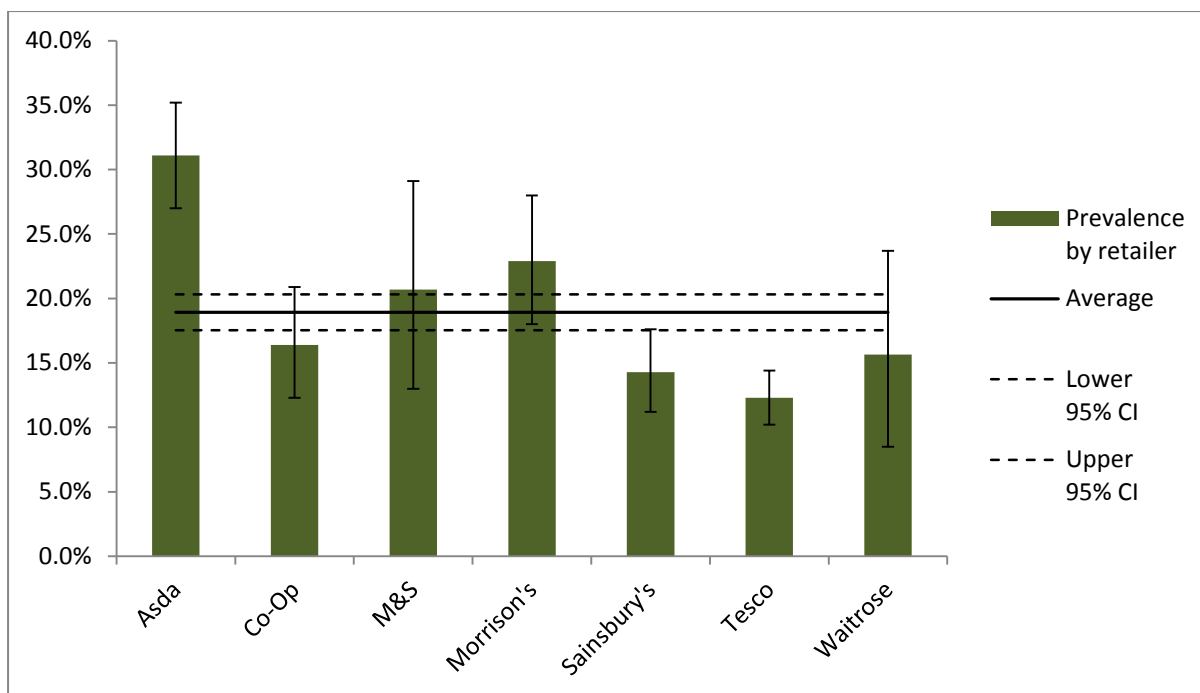


Figure 1: The % of chickens with levels over 1000 cfu/g of Campylobacter (dark green bars), for each of the main retailers (with 95% confidence intervals). The graph also shows the mean level >1000 cfu/g (solid lines), with 95% confidence intervals (dashed lines).

Additional notes

This report only shows results from the first three quarters of a year-long survey, so users should exercise caution in their interpretation. Overall prevalence of Campylobacter, and results for each of the retailers, may change with the next quarter's results, due to be published in May 2015.

The samples informing this report were taken between February – November 2014, so more recent interventions that retailers and processors have introduced may not be reflected in these results.

All chickens, no matter which retail outlet they are sold from, are at risk of being contaminated with Campylobacter, which is why it is important for consumers to handle and cook their chicken safely. Effective cooking will kill any Campylobacter on the chicken.

The future of the survey

The final release of headline results from the current survey is scheduled for May 2015. This will provide a cumulative 12-month summary as well as a study of variation across the year.

There are other survey variables by which results could be disaggregated, e.g. to explore possible differences associated with the nature of production (free-range, housed, etc), or pack weight, amongst others. These associations are best studied as part of a considered analysis that takes account of the correlations between all the variables involved. Such an analysis will be included as part of a more in-depth report, issued sometime after the release of the headline results in May. The raw data from the survey will also be put into the public domain.

The design of the current survey is geared primarily to estimating the mean prevalence of *Campylobacter* in fresh retail chicken in the UK, averaged across all retail outlets (in proportion to market share) and over a full 12-month period. As the survey has progressed it has become clear that there is a high level of interest in the degree of similarity, or difference, in prevalence across major retailers.

The FSA is planning to conduct a follow-up survey, beginning later in 2015. The follow-up survey will be substantially similar to the current survey, but, in order to facilitate better comparison of retailers, a sample size boost will be applied where appropriate. The boost will ensure that the sample size for all retailers, whose market share exceeds a certain cut-off, is no lower than a fixed minimum level. Updated market share data will be procured to inform this. It is possible that there will be a slightly increased number of retailers for whom itemised results will be provided, once this follow-up survey is up and running.

Methodological Annex

Eligibility criteria

Chickens eligible for inclusion in the survey were:

- Whole, chilled, raw, UK-produced standard, free range or organic chickens;
- Where contained in a package, it was unopened and undamaged;
- NOT frozen;
- NOT basted, herbed, stuffed, marinated or otherwise modified.

Samples were collected from retail premises in the UK and information gathered included temperature on receipt, approved premises code and use-by dates.

Statistical features

The survey was designed to get a robust estimate of the typical UK prevalence of *Campylobacter* in whole fresh chicken, averaged across a full 12-month period. The survey is to be used as a baseline against which to assess future *Campylobacter* prevalence. To achieve this end chickens were tested according to a sampling plan aimed at reflecting market share.

Market share data were supplied by Kantar in June 2010 and fulfilled several criteria which made them an ideal fit: the data derived from a large consumer panel; they were UK-wide; they specifically identified UK-produced chicken. Unfortunately, the complexity of the survey, including the crucial importance of rigorously validating the laboratory methods, meant that the survey took longer than expected to get off the ground. In 2012 the FSA approached the original supplier for updated market share data. However, two important features of the data could no longer be replicated: non-UK chicken could not be differentiated from UK-produced; N Ireland sales were no longer included. The FSA decided to try a different approach and asked British Retail Consortium (BRC) to grant access to industry sales data. This was partially successful. However, the data were supplied piecemeal by individual retailers. There was no independent normalisation or validation of data and it was incomplete. Where the BRC data could be compared with the pre-existing 2010 market share data, the two sources were found to be broadly consistent. Since the latter source was more complete, it was decided to use this for final planning of the survey in 2013.

Given the history associated with the market share data, it is possible that there is a degree of under-representation of any retailer whose market share has risen sharply since June 2010. If better market share data were to become available, it would be possible, in principle, to re-weight the survey to correct for this.

Seven main retailers were identified. The survey was designed to return individual sample sizes that reflected their respective market shares. All "other" retailers were pooled into a single group, with sampling of independent butchers approximately reflecting their market share.

The aim was to sample evenly across the year. This has been more-or-less achieved, but is not perfect: e.g. the 1st quarter ended up with slightly fewer than the 1000 samples planned. Because of the possibility of changes due to seasonal variation, a correction was applied so that each quarter has exactly equal weighting in the cumulative results, at each stage of reporting. This is designed to nullify any possible bias due to seasonal imbalance in the sampling.

Confidence intervals, for estimates of prevalence, have been calculated using two different methods. For all prevalence estimates that refer to a UK average, the sample size is sufficiently large as to justify a normal approximation. However, sample sizes are lower at individual retailer level. For robustness, a bootstrap

technique was used to compute all confidence intervals for prevalence estimates that refer to an individual retailer.

Laboratory testing

The testing laboratories were the five Public Health England Food, Water and Environmental Microbiology Laboratories, plus the Agri-Food Biosciences Institute Laboratory in Northern Ireland. Once samples reached a laboratory, testing was usually initiated within 24 hours, and certainly before 48 hours after sampling. Chickens were tested before or on their use-by dates. Handlers prevented cross contamination between samples and from the surrounding environment at all stages, e.g. by wearing gloves and changing them between handling each chicken, and the cleaning of equipment and work surfaces regularly.

Two samples for each chicken were analysed; one sample consisting of 25 g skin (mainly neck-skin), and one sample representing the outer packaging (prepared by examining a sponge swab rubbed over the entire outer packaging of the chicken).

The chicken samples tested were examined using an enumeration method based on ISO/TS 10272-2:2006 Microbiology of food and animal feeding stuffs -- Horizontal method for detection and enumeration of *Campylobacter* spp. -- Part 2: Colony-count technique. Enumeration using direct plating with a detection limit of ten colony forming units (cfu) per gram (g) of neck-skin, or per swab sample, was used.

Any isolates of *Campylobacter* species were sent to the Public Health England laboratory in Colindale for further speciation.

Further information

Additional information on the survey design can be found in the original survey protocol at:-

www.food.gov.uk/sites/default/files/Campylobacter%20in%20Chicken%20PROTOCOL%20FINAL%20with%20amends%20Mar14.pdf