FOOD SAFETY ADVISORY COMMITTEE

Food Borne
Salmonellosis

Report to the
Minister for Health
and the
Minister for Agriculture and Food

REPORT NO. 10
October 1991
FOOD-BORNE SALMONELLOSIS

1. INTRODUCTION

Many people have experienced an attack of food-poisoning which usually consists of a short episode of diarrhoea which may be associated with vomiting. A wide range of micro-organisms such as viruses, bacteria or protozoa may be responsible for such attacks. Salmonellae are an important bacterial cause of food-poisoning. As with almost any kind of infection, contact with disease causing microbes does not inevitably result in a disease.

People routinely cope with a low level of bacterial contamination in much of the food consumed. Natural defences such as acid in the stomach and other protective mechanisms in the gut are enough to kill bacteria eaten in food. However, if we ingest large doses of pathogenic microbes, we are likely to fall ill. This is why food should be stored at 3°C or below to prevent the multiplication of microbes in the food.

2. HABITAT

The normal habitat of Salmonella is the intestinal canal of many species of animals. The organisms have been isolated from the intestine of the python, the elephant and frequently from the pet tortoise.

Poultry provide the greatest reservoir of infection, most often hens, chickens and ducks. Pigs are possibly the next most frequent source. Cattle and sheep are less commonly affected. Rats may be heavily infected especially if they have access to offals and animal by-products.

Salmonellae have been isolated from mussels and other shellfish. They can survive in soil for the greater part of a year. They have been found in sludge and effluent from sewage works. With infection common in the farmyard and in the wild, a great part of our food supply is obviously at risk, e.g. meat, milk and eggs. (See Fig. 2 from Technical Report Series 774).
Fig. 2  Salmonella cycling and recycling

Adapted in Technical Report Series 774 from Salmonella, the Food poisoner - a report by a study group of the British Association for the Advancement of Science, London 1978.
3. BACTERIOLOGY AND EPIDEMIOLOGY

(a) Salmonellae were first isolated in 1886 by Dr. Salmon, a veterinary pathologist in Washington D.C.

(b) In developed countries Salmonellosis is an important food borne disease.

(c) The genus Salmonella is a member of the family Enterobacteriaceae. The bacterium is gram negative and there are more than 2,000 serotypes.

(d) From an epidemiological point of view, salmonellae can be classified into three main groups; the first group comprises Salmonella typhi and paratyphi A and C, which infect only man and are spread directly or indirectly via water and food from person to person. The second group includes serotypes that are host adapted, e.g. Salmonella gallinarum in poultry. The third group contains the majority of other Salmonella serotypes with no particular host preference, that infect both man and animals.

(e) Salmonellae grow at temperatures between 8°C - 45°C and can multiply in an environment with a low level of oxygen or no oxygen. They are relatively resistant to drying, salting, smoking and freezing of food.

(f) Salmonellae are sensitive to heat and will not survive temperatures above 70°C or pasteurization. When eggs are boiled, the yolks are unlikely to reach temperatures sufficient to kill Salmonella enteritidis until after about seven minutes boiling.

Salmonellosis together with Campylobacter enteritis and other zoonotic diseases make up a large percentage of cases reported in developed countries. In some of these cases there is evidence that an infection may be associated with a low infective dose (less than 10 organisms per gram for S. typhimurium in cheddar cheese).

Special problems associated with Salmonella are explosive outbreaks in hospitals, particularly maternity, paediatric and geriatric units.

4. TRENDS IN SALMONELLA INFECTIONS IN HUMANS

The Salmonella serotypes associated with food poisoning incidents tend to change over the years. In the seventies S. agona and S. hadar were responsible for up to 40% of documented incidents in the U.K. S. enteritidis has now become a common isolate in the U.K. and Ireland. Table 1 shows the most common serotypes in human food poisoning and Table 2 lists the serotypes most commonly isolated in veterinary practice in Ireland over the past 4 years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S. enteritidis</td>
<td>58</td>
<td></td>
<td>S. enteritidis</td>
<td>173</td>
<td></td>
<td>S. enteritidis</td>
<td>181</td>
<td></td>
<td>S. enteritidis</td>
<td>324</td>
</tr>
<tr>
<td></td>
<td>S. schwarzengrund</td>
<td>48</td>
<td></td>
<td>S. schwarzengrund</td>
<td>22</td>
<td></td>
<td>S. schwarzengrund</td>
<td>37</td>
<td></td>
<td>S. breedeney</td>
<td>99</td>
</tr>
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</table>


<table>
<thead>
<tr>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
<th>Year</th>
<th>Serotype</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S. typhimurium</td>
<td>60</td>
<td></td>
<td>S. typhimurium</td>
<td>52</td>
<td></td>
<td>S. typhimurium</td>
<td>95</td>
<td></td>
<td>S. typhimurium</td>
<td>156</td>
</tr>
<tr>
<td></td>
<td>S. schwarzengrund</td>
<td>8</td>
<td></td>
<td>S. enteritidis</td>
<td>106</td>
<td></td>
<td>S. enteritidis</td>
<td>56</td>
<td></td>
<td>S. enteritidis</td>
<td>81</td>
</tr>
</tbody>
</table>
5. **ANTIBIOTIC RESISTANCE IN SALMONELLA**

Reports from the U.K. show that antibiotic resistance is common in *Salmonella typhimurium*, but much rarer in the other salmonella serotypes. In Ireland antibiotic sensitivity testing of strains isolated from 1987 onwards shows that nearly all of the isolates are sensitive to ampicillin, gentamicin, cephalosporins, neomycin and chloramphenicol. The over use of antibiotics in animal husbandry is a cause of the appearance of resistant strains.

6. **SALMONELLA IN POULTRY AND EGGS**

In industrialized countries 50% of all poultry carcases may be infected with salmonella. Veterinary findings show that *S. enteritidis phage type 4* (PT 4) infection can involve the ovaries and oviducts. Experience in the United Kingdom has shown that eggs have become a common source of salmonella food-poisoning in outbreaks reported to the Public Health Laboratory Service, Colindale, London (PHLS) in which an attributable food has been identified. *Salmonella enteritidis PT 4* is the organism most frequently implicated in these outbreaks.

The examination of shell eggs obtained at random from retail shops and other outlets is not very useful. It is better to try and trace the flocks of hens that have laid the eggs associated with human cases and then to test the eggs from the flocks. Recent experience has shown that, even in flocks that are infected, the eggs are only infected intermittently. The number of salmonella isolated from infected eggs, whether they were stored at 4°C or at room temperature, does not seem to differ.

Experimental studies have shown that *S. enteritidis PT 4* is not unusually heat resistant. When boiled the yolks of eggs are unlikely to reach temperatures sufficient to kill *S. enteritidis* until after about 7 minutes cooking.

More detailed information on the control of salmonella in poultry and eggs is given in the Appendix.
SOCIO-ECONOMIC ASPECTS OF SALMONELLOSIS

The cost of salmonellosis in man would include hospital and medical costs, lost production in the workplace, lost leisure, investigatory costs and loss of life. A recent study estimated the total cost of salmonellosis in man at £59 million per year in Canada. An equivalent annual figure for the Republic of Ireland would amount to £8 million.

The financial repercussion of an outbreak of salmonellosis on restaurants or food processing premises where food is mishandled can be substantial. These costs vary widely as is evident from the data in Table 3 (cited in W.H.O. Technical Report Series 774, 1988).

<table>
<thead>
<tr>
<th>FOOD</th>
<th>COUNTRY</th>
<th>NUMBER OF PERSONS</th>
<th>TOTAL COSTS</th>
<th>AVERAGE TOTAL COSTS PER CASE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>ILL</td>
<td>DEAD</td>
<td>(MILLIONS OF CAN. $)</td>
</tr>
<tr>
<td>Raw milk</td>
<td>Scotland</td>
<td>654</td>
<td>2</td>
<td>1.38</td>
</tr>
<tr>
<td>Cheese</td>
<td>USA</td>
<td>234</td>
<td>0</td>
<td>0.23</td>
</tr>
<tr>
<td>Cakes</td>
<td>Canada</td>
<td>44</td>
<td>0</td>
<td>0.04</td>
</tr>
<tr>
<td>Cocoa</td>
<td>Sweden</td>
<td>110</td>
<td>1</td>
<td>3.37</td>
</tr>
<tr>
<td>Chocolate</td>
<td>Canada/USA</td>
<td>200</td>
<td>0</td>
<td>62.10</td>
</tr>
<tr>
<td>Diet drink(a)</td>
<td>USA</td>
<td>245</td>
<td>0</td>
<td>0.25</td>
</tr>
<tr>
<td>Chicken</td>
<td>Australia</td>
<td>450</td>
<td>0</td>
<td>1.76</td>
</tr>
</tbody>
</table>

(a) Defective product recalled; no illness known to have occurred.

COST-EFFECTIVENESS OF VETERINARY MEASURES

In a recent study the cost-benefit of different control measures for salmonellosis in the Canadian poultry industry was examined and is shown in Table 4 (taken from W.H.O. Technical Report Series 774, 1988). The effectiveness of education of the consumer and employees in the food-service industry is evident.
<table>
<thead>
<tr>
<th>CONTROL MEASURE</th>
<th>COST (MILLIONS OF CAN. $)</th>
<th>BENEFIT(^{(a)}) (MILLIONS OF CAN. $)</th>
<th>OTHER BENEFITS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaning of hatching eggs and hatcheries (maintaining hygienic conditions and fumigating eggs)</td>
<td>3.9</td>
<td>1.3</td>
<td>Reduction in other poultry diseases</td>
</tr>
<tr>
<td>Production of clean feedstuffs (fumigation in feed mills and rendering industry)</td>
<td>7.5</td>
<td>9.8</td>
<td>Reduction in other poultry diseases</td>
</tr>
<tr>
<td>Cleaning of grower barns</td>
<td>7.6</td>
<td>8.6</td>
<td>Reduction in other poultry diseases</td>
</tr>
<tr>
<td>Nurmi culture(^{(b)})</td>
<td>25.7</td>
<td>24.0</td>
<td></td>
</tr>
<tr>
<td>Cleaning of poultry crates (cleaning and disinfection, efficient crate washers)</td>
<td>0.8</td>
<td>13.2</td>
<td>Reduction in other bacteria</td>
</tr>
<tr>
<td>Clean poultry processing</td>
<td>0.6</td>
<td>8.4</td>
<td>Reduction in other bacteria</td>
</tr>
<tr>
<td>Irradiation of processed poultry</td>
<td>18.5</td>
<td>52.7</td>
<td>Reduction in other pathogens, increased shelf-life</td>
</tr>
<tr>
<td>Education of the consumer (once per year)</td>
<td>0.4</td>
<td>7.4</td>
<td>Reduction in other bacteria and in salmonella contamination of other foods</td>
</tr>
<tr>
<td>Education of employees in the food service industry (every 2 years)</td>
<td>1.9</td>
<td>10.1</td>
<td>Reduction in other bacteria and in salmonella contamination of other foods</td>
</tr>
</tbody>
</table>

\(^{(a)}\) Benefits refer to the reduction in human salmonellosis and associated costs and/or an increase in the productivity in the poultry sector.

\(^{(b)}\) Nurmi culture not yet used on commercial scale.
FOOD HYGIENE ASPECTS

The following control measures are recommended by this Committee.

(1) Every effort should be made to prevent the entry of infection from animal excrement and or contaminated feeding stuffs into flocks of chickens and turkeys and herds of cattle and pigs.

Strenuous efforts must be made to limit the spread of infection if introduced.

Regular monitoring of breeding and broiler flocks should be undertaken.

(2) Hygienic codes of practice should be introduced so as to reduce contamination of the carcase during slaughter and dressing. The carcase should be chilled immediately after dressing.

(3) Special attention should be given to the preparation and refrigeration of foods e.g. home made egg mayonnaise, cold desserts and pre-cooked savouries, to prevent growth and multiplication of organisms.

(4) Heat destruction of organisms in milk and food by pasteurization or sterilization.

(5) Proper cooking as well as good hygienic practices to prevent re-contamination after cooking.

(6) Education and increased awareness of consumers and of employees in the food-service industry.

(7) Improved notification and reporting of infected cases.

(8) Investigation of all cases of salmonellosis.

The Food Safety Advisory Committee wishes to acknowledge the assistance of the Department of Agriculture and Food in providing the information set out in the Appendix.

Figure 2, Table 3 and Table 4 are reproduced, by permission from Salmonellosis Control: the role of animal and product hygiene. Report of a WHO expert committee 1988. World Health Organization Technical Report Series 774, 1988.

Figure 2 was adapted in Technical Report Series 774 from Salmonella, the food poisoner. A report by a study group of the British Association for the Advancement of Science, London 1978.

APPENDIX

THE POULTRY INDUSTRY: SOME BACKGROUND INFORMATION

The poultry industry is from a food production point of view one of the most sophisticated. This is in part due to the fact that on a world wide basis this industry is controlled at primary breeding level by relatively few, generally multinational companies with resources at their disposal for research which has been directed mainly in the areas of genetics, nutrition and disease control. The rapid growth and short maturing period of poultry relative to other species has certainly aided these developments. It is an industry that has in the past 30 years or so moved from being merely a backyard operation to becoming one that is highly intensive. The emphasis has in the past been on improving the feed conversion and meat to bone ratios which have improved dramatically. Improvements in housing, hygiene management and vaccine production have reduced the mortality and morbidity levels of flocks considerably over the same period. Research continues in reducing production costs by improving genetic material, reducing abdominal fat in broilers and improved egg quality with increased hatchability and fertility.

The commercial producers, be they involved on a small or large scale, receive the benefits of the research at primary breeding level where accurate projections can be made for production parameters of poultry generations into the future.

The Irish poultry industry has developed along similar lines to that in other advanced nations but on a smaller scale, although the degree of integration and scale of operations in Ireland are not as extensive as in other countries.

For ease of discussion, this industry is best divided into its two main segments – meat production and egg production.

There is some overlap between these two segments as the hens used for egg production eventually enter slaughter and processing plants.
MEAT PRODUCTION

There has been movement towards contract rearing on the part of the slaughter plants for economic reasons. This contributes to stability of supply. There are 16 officially approved poultry processing plants catering for the whole country and of these, 6 process the majority of the poultry. Poultry meat consumption increased by 40% from 1970 to 1979, using 1968 as a base. Between the years 1980 to 1989 consumption increased by approximately 20% of the 1980 level.

Commercial broilers grow rapidly and are slaughtered at 4.5 to 8 weeks of age while commercial turkeys are slaughtered at varying ages from 9 to 17 weeks, depending on weights, required and strains of birds. While broiler production has been an all year round operation for quite a time, turkey production, previously a Christmas and Easter trade, has more recently followed suit and is now well integrated. However, there are still a considerable but falling number of small producers for the traditional Christmas trade production.

Total annual production of turkeys is approximately 4 million versus 38 million broilers and 2 million layers. Broilers are sold fresh, chilled or frozen as carcasses and a more recent development is the increase in portioned poultry, minced products (e.g. nuggets) and cooked products which account for 25% of poultry on the market.

EGG PRODUCTION

Commercial hens produce on average 280 eggs per year. National production is of the order of 600 million eggs per annum. This sector is much less integrated than the poultry meat sector. Approximately 70% of hens in Ireland are kept in battery cages versus 90% in the United Kingdom and 87% in the European Community as a whole.

IMPORTS

Significant quantities of eggs are imported from Northern Ireland and fresh poultry meat is imported from Northern Ireland, Denmark and France. In addition there are imports of poultry meat products from the Netherlands and Germany. In any consideration of possible sources of Salmonella associated with the poultry industry imported products must be investigated.
STRUCTURE OF MEAT SECTOR

PRIMARY BREEDERS (Grandparent Stock)

HATCHERY --- DAY OLD CHICKS

COMMERCIAL BREEDERS (Supply Farms) (Parent Stock)

HATCHERY --- DAY OLD CHICKS

COMMERCIAL PRODUCERS (Growers)

POULTRY SLAUGHTER PLANTS

WHOLESALE

FURTHER PROCESSING

RETAIL

CONSUMERS
STRUCTURE OF EGG INDUSTRY

PRIMARY BREEDERS (Grandparent Stock)

HATCHERY --- DAY OLD CHICKS

COMMERCIAL BREEDERS (Supply Farms) (Parent Stock)

HATCHERY --- DAY OLD CHICKS

COMMERCIAL PRODUCERS (Egg Production)
(Occasionally Packers)

EGGS

PACKERS

WHOLESALERS

AGENTS

RETAIL

CUSTOMERS
## INDUSTRY PROFILE

<table>
<thead>
<tr>
<th></th>
<th>Domestic Poultry</th>
<th></th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Broiler Sector</td>
<td>Eggs Sector</td>
</tr>
<tr>
<td>Grand Parent Producers</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Grand Parent Farms</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grand Parent Hatcheries</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Chicks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Stock Producers</td>
<td>83</td>
<td>5</td>
</tr>
<tr>
<td>Parent Stock Farms</td>
<td>91</td>
<td>6</td>
</tr>
<tr>
<td>Eggs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Parent Stock Hatchery</td>
<td>14 (4 dual)</td>
<td>4 (3 dual small)</td>
</tr>
<tr>
<td>Chicks</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial Growers</td>
<td>Approx. 256</td>
<td>244 (includes 102 free range)</td>
</tr>
<tr>
<td>Egg Packers</td>
<td>-</td>
<td>104 (includes 45 free range)</td>
</tr>
<tr>
<td>Poultry Meat Factories</td>
<td>16</td>
<td>-</td>
</tr>
</tbody>
</table>

It can be seen from the above outline that the poultry industry structure is effectively in the form of a pyramid with the highest genetic material at the top, in Ireland that is grandparent level, (in other countries this could be great grandparent or even pure lines level) parent stock in the middle and commercial stock at the base.

This pyramid is significant in the approach to control of vertically transmitted diseases such as *Salmonella enteritidis*. 
IN GENERAL

Day old chicks are placed in clean houses, grown to processing weight and removed over a period of days to slaughtering plant, house completely cleaned out and cycle restarted. Many but not all sites operate similar policy. The growing period is 32 to 56 days.

Commercial layers have a 20 week growing period and approximately one year in production. Growing and production are normally on different sites - (reared on litter and producing in cage systems). However, unlike commercial broilers it is more common to have multi age sites which though desirable from an economic and staff management point of view are undesirable from a disease control aspect as lateral spread is facilitated and recontamination of depleted cleaned/disinfected and subsequently restocked houses may occur.

Parent Breeding Stock may be reared and put into production in the same house (kept on litter not in cages). The trend is also to keep these in 'all in all out' sites (more conducive to disease control).

Grandparent stock are imported into quarantine situations supervised by the Department of Agriculture and Food and are moved from quarantine sites to production sites.

SIGNIFICANCE OF SALMONELLA ENTERITIDIS IN POULTRY

The first reported isolation of Salmonella enteritidis was from human faeces during an epidemic of food poisoning in 1888 at Frankenhäuser in Germany. Since then the organism has been isolated from a wide range of domestic and wild animals in many countries of the world (Buxton 1957). S. enteritidis was first isolated from domestic poultry in 1935 (Schaaf 1935).

Sojka and other (1975) reported that in England and Wales during the period 1968 to 1973, S. enteritidis accounted for 150 (9%) of the 1,744 salmonella isolates recorded from poultry. Subsequently S. enteritidis accounted for only 89 (1.2%) of the 7,123 salmonella isolates recorded from poultry between 1976 and 1985 (Ministry of Agriculture, Fisheries and Food 1987). It was only in 1986 that S. enteritidis was recognised as a frequent and serious pathogen of poultry in Great Britain (O'Brien 1988). The organism has been isolated from broiler, breeder and commercial egg laying flocks (Hopper and Mawer 1988, Lister 1988).

S. enteritidis appears to replicate readily in poultry and may become disseminated throughout an integrated poultry organisation. 'Vertical' transmission of infection to broilers has been suggested from epidemiological observations (O'Brien 1988) and from the reported identification of S. enteritidis in ovarian tissue from a parent broiler flock (Lister 1988).

Such a mode of transmission would be highly effective in disseminating infection throughout the poultry industry,
resulting in contaminated poultry meat and egg products. The organism has been isolated from the outbreaks of S. enteritidis food poisoning in man associated with eggs, both in Great Britain (Coyle and others 1988) and USA (St. Louis and others 1988). (S. G. McIlroy, R. M. McCracken, S. D. Neill, J. J. O'Brien 1989).

Apart from its significant capacity to cause food poisoning in humans S. enteritidis in contrast to most non host specific serovars is transovarianly transmitted so that normal practices of disinfection/fumigation of hatching eggs is ineffective and the organism is transmitted vertically to the progeny in the case of hatching eggs and in the case of table eggs contamination may be both on shell surface and within the egg.

In poultry S. enteritidis does not normally cause clinical disease in adult birds but may cause increased mortality in very young chicks particularly at 7 to 10 days old - only some of the chicks being affected. In those that recover no further sign may be seen until birds go into production and the eggs produced either as table eggs or hatching eggs give rise to problems. Chickens once infected and recovered appear to be intermittent shedders during egg production phase. It has been estimated that in infected flocks 2 to 4% may become intermittent shedders. So, difficulties arise in relying on eggs alone to prove flocks positive.

For this reason - transovarian invasiveness / vertical transmission-- the control/elimination of S. enteritidis in poultry is best approached through establishing freedom at the top of the genetic pyramid. This, once established will over time, provided due attention is given to prevention of either recycling on sites and horizontal transmission e.g. from feed equipment etc., work its way down the pyramid, each breeding level being a multiplication level. It is imperative in an outbreak to quickly establish which levels in the pyramid are affected so that rapid corrective action may be taken. This is why the Department of Agriculture and Food has directed its limited resources towards sampling at hatchery level where results obtained reflect the status of breeding flocks supplying the hatchery being sampled and the progeny produced.

SALMONELLA MONITORING CODE

General:

The Salmonella Monitoring Code was introduced by the Poultry industry in consultation with the Department of Agriculture and Food. Although the Code is intended to be operated by the industry and its private veterinary advisors, Department personnel have been involved at all levels, particularly in monitoring the results obtained by the veterinary advisors and in its own monitoring.

The Department's direct input has been in four main areas:

- slaughter plants,
- breeding flocks/hatcheries,
- commercial flock breeding farms, and
- investigative work where human cases of Salmonellosis have been diagnosed.
Commercial Broilers:

Each week 50 carcase samples are taken at random by Department personnel from poultry slaughter plants for examination at the Central Veterinary Laboratory, Abbotstown, Co. Dublin. Although taken at random the growing flocks to which the birds relate are known. The samples are from birds in the age range 32 to 56 days of age (normal broiler production).

Positive results are notified to (1) veterinary advisor to the flock, (2) management of the poultry slaughter plant, and (3) veterinary officer in charge of the slaughter plant.

Because of the growth and slaughter pattern in the broiler sector sample results are known before the house from which the flock came is restocked, this allows for increased attention to hygiene practices before restocking. Farms in which positives are found are subjected to increased sampling by the veterinary advisor.

Based on flock identification positive cases can be traced to the specific hatchery where records can be examined and if necessary further samples be taken to identify possible positive breeding farms.

The slaughter plant programme is of particular value as 95% of the poultry meat produced in the State is derived from these plants. The current sampling programme running at 2,500 samples per year provides a good monitor.

Breeding Flocks/Hatcheries:

Sampling is concentrated at hatchery level, where fluff and if indicated dead-in-shell samples are taken at monthly intervals. Positives are traceable to the breeding flocks where both environmental and direct swabs are taken from birds. By agreement with the industry flocks in which positive results are found are slaughtered out and the birds fully cooked.

Commercial Flocks (Table Egg):

All breeding flocks and hatcheries are subject to routine monitoring. This provides the basis for the placement of clean chicks in rearing and ultimately laying flocks. No problems have been found in the breeding flocks.
Investigative Work:

In response to human cases of Salmonellosis, such as the recent cases in Cork, supply farms to egg packing stations and liquid egg producers were identified, each flock was subjected to environmental sampling. Where positive results were found in addition to further environmental sampling all flocks were sampled on the basis of 60 birds per house per week for three weeks. All individual bird samples were negative. Supply flock information gave rise to further investigation of flocks in Co. Monaghan where individual bird sampling gave positive results. Two flocks were slaughtered out and the birds fully cooked. Other flocks are still under active investigation.

Feedstuffs:

The Cereals Division of the Department of Agriculture and Food is involved in an on-going monitoring of feedstuffs at mills and other locations, on foot of specific inter departmental requests. Since inception S. enteritidis has not been recovered from feed here. It has been found in imported raw materials elsewhere. The consequent recommendation to the poultry industry is to use heat treated feeds or feeds in pelleted form. Unfortunately the commercial egg layer sector does not find it suitable from a husbandry/management/economic point of view to use heat treated feed.

Situation in Ireland and in Great Britain:

There are risks attached to assuming the situation to be the same in both countries and basing conclusions solely on the experience in Great Britain.

At the outset there was an advantage that concern related to S. enteritidis in Ireland arose subsequent to the highlighting of problems in Great Britain. The media fuss in Great Britain had an effect of creating a climate of opinion within the industry that rapid response would be necessary to safeguard their interests.

Secondly as outlined in the introduction we had the advantage of having in the poultry meat sector, where we first encountered S. enteritidis problems, a well integrated sector controlled at processing and breeding level by relatively few individuals already known to the Department and a good umbrella liaising organisation. These factors allowed for agreement to implement the voluntary removal from the sector of infected flocks identified either by the Department or privately. Even with these advantages, a certain length of time elapsed, before a more streamlined approach evolved, based on experience.

The egg sector has less integrated structure/husbandry methods at commercial level. Economic factors applicable to the sector together with a lack of a cohesive umbrella liaising group resulted in slower reaction and slower adoption of a positive approach.
On the other hand there was the advantage that at breeder level
there were only a few people involved and S. enteritidis has
not been isolated or identified to our knowledge in the table
egg sector in Ireland unlike the situation in Great Britain.

In the initial stages prior to the establishment of the
Salmonella Monitoring Programme / Code of Practice, the
downstream effects of infected poultrymeat breeding stock were
self limiting i.e. at the commercial level once the offending
breeding flocks were removed due to the short life cycle of
broilers the effects were self limiting. The subsequent
problems encountered were of a recontamination nature
i.e. recycling on commercial grower sites.

Had we had a similar problem in the egg breeding stock the
downstream effects would have had far greater consequences over
a greater length of time and would have stretched resources
beyond limits at the time and perhaps the problem would have
been uncontrollable.

There have been sporadic cases at commercial egg level probably
initially before sampling programme stage infected through
indirect contact with the broiler sector - feed etc., and the
methods of husbandry have not helped control.

For these reasons it has been harder to identify problems as
quickly as we would like. Fortunately the excellent
co-operation of the Department of Health has alerted us to some
of these problems.

In Great Britain where the size of the industry is much
greater, official control action was introduced at a later
stage of the outbreak than in Ireland. Under media, political
and industry pressures action had to be formulated in the light
of a new experience, when all the facts were not yet available.
So the situation and outcome in Great Britain were rather
different to those in Ireland.

We were fortunate to have been able to observe their ongoing
experience and react accordingly. Certainly the legislative
base for control available in Great Britain is enviable.
However, where resources are not available to fully enforce
such legislation a voluntary "seek, find and remove policy" as
was adopted here has achieved in the short term what
legislation alone without goodwill can not. In the long term
control legislation is desirable as there is a tendency for
complacency to appear in the absence of continual heightened
awareness as occurs in the face of major outbreaks of disease.
PRESENT POSITION

For some considerable time \textit{S. enteritidis} had not been identified in the poultry meat or layer breeding stock sectors and the only episode encountered had been in a tiny unit which was linked to a previous problem with subsequent recontamination. In January 1991, all commercial broiler flocks were to our knowledge clear. Based on the Department's monitoring programme from March 1990 to January 1991, no \textit{S. enteritidis} positive carcases went out on to the market from approved plants.

Re: \textit{Salmonella typhimurium}

The Code of Practice applies to \textit{S. enteritidis} and \textit{S. typhimurium} and under this code positive breeding stock flocks have been removed by the industry in accordance with the agreement. Under the Department monitoring programme \textit{S. typhimurium} has been recovered at hatchery level on only one occasion. It is our observation that recontamination on sites has been a significant factor in the sporadic occurrences of \textit{S. typhimurium} in broiler flocks. The ubiquitous nature of \textit{S. typhimurium} makes it even more difficult to eliminate from or prevent entry on to sites than \textit{S. enteritidis}.

All the general comments re \textit{S. enteritidis} and the recommendations would equally apply to \textit{S. typhimurium}.

PROPOSED LEGISLATION

1. Liquid egg/egg products for further use in manufacture are to be controlled by an EC Directive already adopted in Brussels due to come into force by the end of 1991. However this Directive or major elements of it are expected to be introduced by the Department of Agriculture and Food as soon as draft legislation has been cleared by Parliamentary Draughtsman's Office.

2. Draft zoonosis Directive - still at Commission discussion level in draft documents has addressed the problem of \textit{Salmonella} in poultry and will allow for monitoring of the industry.

3. New legislation to require mandatory heat treatment of feedstuffs fed to poultry, will bring the commercial egg layer flocks into line with established practice in the broiler and turkey sectors. This legislation also provides for the registration of all flocks.
FOOD SAFETY ADVISORY COMMITTEE

FOOD-BORNE SALMONELLOSIS

REPORT NO. 10

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