



Keldur

Institute for Experimental
Pathology, University of Iceland

25 years of *Campylobacter* and Campylobacteriosis in Iceland - lessons learned

Vala Friðriksdóttir

EURL-Campylobacter workshop 2022



The Institute for Experimental Pathology at Keldur

The Icelandic Veterinary Institute

- Veterinary Diagnostic Services
 - Pathology, Histopathology, Bacteriology, Antimicrobial Resistance, Parasitology, Virology, Molecular Biology, Prionology, Fish Diseases
- Research Projects - Animal Health
 - Focus on Horses, Sheep and Fish
- NRL – National Reference laboratories
 - *Campylobacter*, Antimicrobial Resistance, Parasites, TSE, Fish Diseases, Scallop Diseases
- Accredited laboratories
- Vaccine production
- Blood products, Microbiological culture media
- Own legislation and finances

Campylobacter and poultry

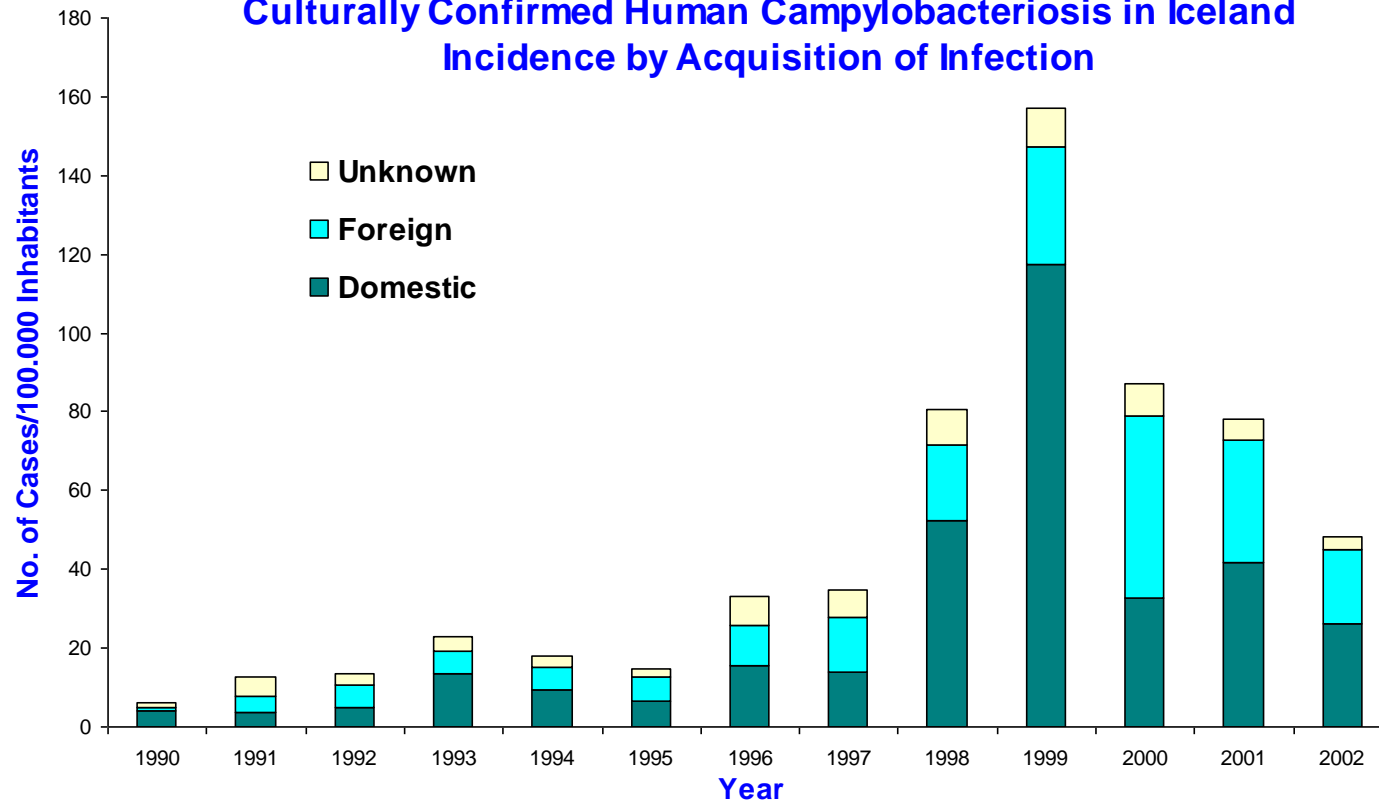


- Poultry part of Icelandic farming from the beginning of times
 - Viking settlers (9th century) brought hens to Iceland
 - The “Settlers hen” – almost did not make it through hard times
- Modern poultry farming started 1940-1950
 - Broilers, turkeys, eggs
 - In the beginning only allowed to sell **frozen** chicken meat
 - **1996** allowed to sell **fresh** chicken meat
 - **1996-1999** proportion fresh meat increased rapidly **<5% - 60%**
- Human Campylobacteriosis
 - Rapid increase **1998-2000**
 - **Domestic** origin
 - Linked to increased consumption of **fresh** poultry meat
 - Consumers not aware of risk
 - Incorrect handling of meat

Human Campylobacteriosis 1990-2002

1999 epidemic linked to consumption of fresh poultry meat

Institute of Laboratory Medicine, Dept. of Clinical Microbiology, LUH
Culturally Confirmed Human Campylobacteriosis in Iceland
Incidence by Acquisition of Infection



Campylobacter in Iceland - animals and nature

- Before 1998 - little known about *Campylobacter*
 - *Campylobacter fetus* isolated from **aborted sheep**
 - *Campylobacter* **not** considered a problem in poultry production
 - *Campylobacter* control **not** included in regulatory control in poultry production
 - Only mandatory *Salmonella* control
- 1999-2000 - mapping *Campylobacter* **distribution**
 - *Campylobacter* widely distributed in nature
 - Farm animals, wild birds, surface water, sewer
 - Important to show care when handling **poultry products, untreated surface water, raw unpasteurized milk**
 - Was the main cause of human *Campylobacteriosis* in 1998
 - 2021 still the main cause

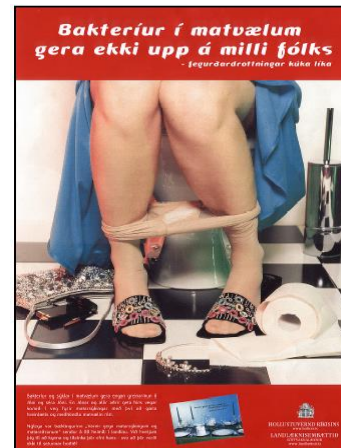
Interventions - Preventive measures

- Campylobacteriosis epidemic (1998-2000)
 - *Campylobacter* control **implemented** in broiler production and slaughterhouses
 - Consumer **education** to prevent infection
 - Advertisement campaign
 - **Cleanliness** and **correct handling** of raw material



**Það iðar allt af lífi
í eldhúsum landsins**

Þessi er mynd af eldhúsi í Reykjavík sem hefur verið notað í eldhúsum landsins. Þetta er mynd af eldhúsi í Reykjavík sem hefur verið notað í eldhúsum landsins. Þetta er mynd af eldhúsi í Reykjavík sem hefur verið notað í eldhúsum landsins.



Campylobacter control - broilers

- Unique broiler flock breeding lot ID-number (**RIInr**)
 - All information about *Campylobacter* (and *Salmonella*) status linked to **RIInr**.
 - Official information collected regularly
- Increased **biosecurity**
 - Broiler house entrances

RIInr. 050-11-26-8-05

Farmers ID number Year of hatch Week of hatch Number of hatch Broiler house

Before

Kept *Salmonella* out but not *Campylobacter*



After

Campylobacter also kept out



The “Campy on Ice” Project (2001-2004)

Scientists USA, Canada, Sweden and Iceland
USDA grant

- “Sources and Risk Factors for *Campylobacter* in Poultry and Impact on Human Disease in a Closed System”
- Use Iceland as a model - well fitted
 - Good registration, closeness, few poultry breeders, easy to obtain and gather information, etc.
 - Collect **samples** for culture and/or DNA isolation at various stages of chicken breeding and broiler production
 - Collect various geographical, meteorological and environmental information
 - Generate database with all information, **geospatial analysis**
- Try to trace *Campylobacter* infection in chicken
 - Identify most important **routes** of infection
 - Identify **factors** contributing to infection

“Campy on Ice” Project – Lessons learned

- **Biosecurity** – key factor
 - Cleanliness, hygiene barriers
 - All in – all out (no thinning)
 - Disinfection of transport cages
 - UV treatment of water
- **Age** of broilers at slaughter is important
 - Especially during summer if biosecurity fails
 - Risk of infection increases with age
 - Age at slaughter 34-36 days

“Campy on Ice” Project – More lessons learned

- Freezing policy - 2000
 - Freezing all meat from flocks that test Campy+ pre-slaughter
 - Freezing reduces *Campylobacter* on meat
 - Carcasses kept at -20°C for at least 2 weeks – 1 log reduction
 - Lowers risk of infection up to 90%
 - Farmers economically driven
 - Get higher price for fresh meat than frozen
- Plan slaughter according to *Campylobacter* status
 - Test faecal samples no later than 5 days before slaughter
 - Prevent product cross-contamination in the slaughterhouse
 - Campy+ flocks slaughtered at the end of the week

Campy on Ice - What we also learned

- No **vertical** transmission of *Campylobacter*
 - Grandparent flocks (Sweden) – **52%** Campy+
 - **Fertilized eggs imported**
 - Broiler parents (Iceland, 6 weeks old) - **0%** Campy+
 - Maternal antibodies only protective 2-3 weeks
 - Broiler parents (Iceland, 19 weeks old) – **69%** Campy+
 - **No shared** *Campylobacter* flaA SVR alleles between grandparent and broiler parent flocks
- Proximity to **cattle farms**
 - appears to increase *Campylobacter* risk, **flies ?**
- Human *Campylobacteriosis* peak **before** broiler peak
 - Is there a common source of *Campylobacter*?

Campy on Ice – Still more lessons learned

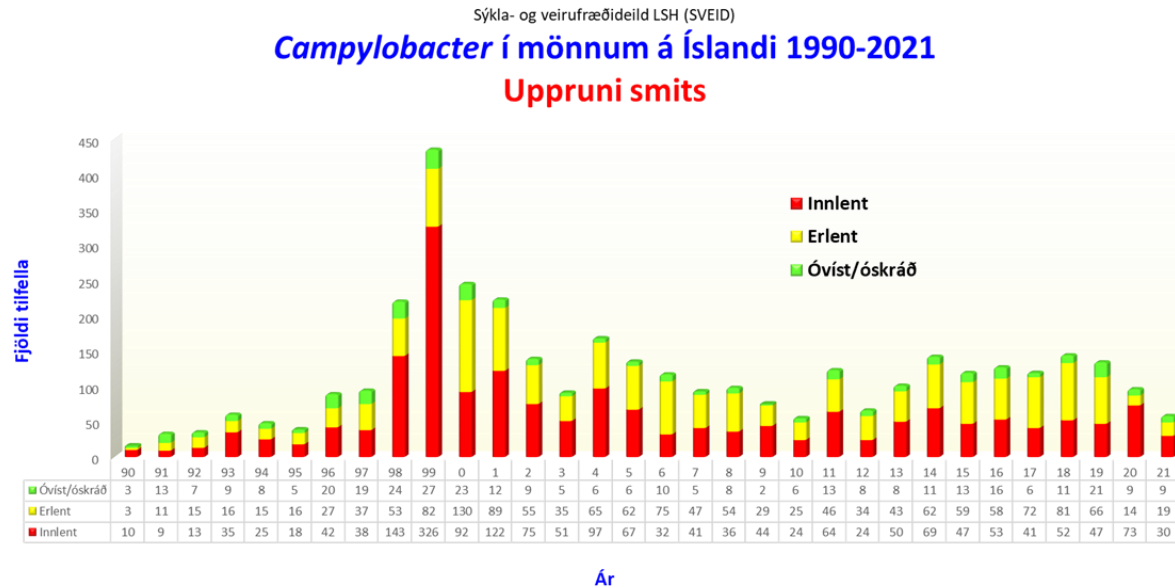
- Important to keep **flies** out of the houses
 - Insect **nets** can reduce Campylobacter load in broiler houses
 - Especially during the **summer** months
 - Winter weather destructive to net structures



Human Campylobacteriosis 1990-2021

Still most common cause of zoonotic infection in Iceland
Year 2019 – **38.1** pr. 100.000 inhabitants (Europe 59.7)

- **Red** – domestic origin
- **Yellow** – foreign origin
- **Green** – unknown/not registered



Microbial criteria legislation – testing broiler neck skins

Pre-existing legislation in Iceland stricter

- **2020**

- <10 cfu/g - 99.1%
- 10-100 cfu/g - 0.7%,
- >100-500 cfu/g - 0.1%)

- **2021**

- <10 cfu/g - 99.2%
- 10-100 cfu/g - 0%,
- 100-500 cfu/g - 0.3%,
- >500 cfu/g - 0.5%

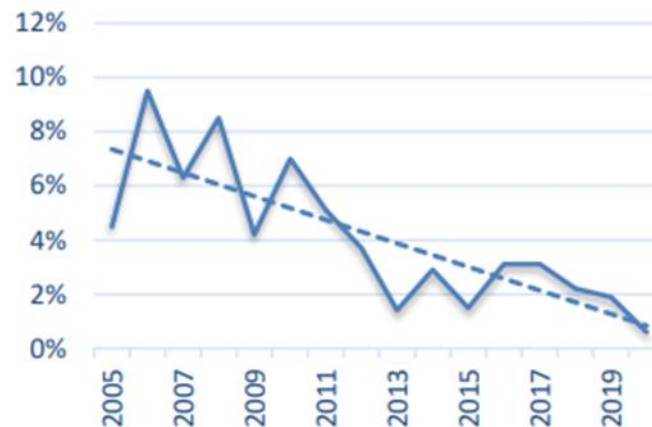
Sampling for antimicrobial resistance in Iceland

- 2020 – broilers caeca
 - 693 samples
 - 7 isolates *C. jejuni*
 - All sensitive to all antibiotics tested
- 2021 – pig caeca
 - 152 samples
 - 145 isolates *C. coli*
 - 110 (75.9%) Ciprofloxacin resistant
 - Sensitive to all other antimicrobials tested
- Europe (8 countries) 2019 and 2020
 - Pigs, *C.coli*, 52.4% CIP resistance
 - 2021 - all EU MSs mandatory *C. coli* antimicrobial resistance results

Campylobacter status - broiler flocks

- Pre-slaughter sampling
 - 2005-2019
 - Percentage of Campylobacter positive flocks decreasing
 - **Control measures work**

Mynd 7. Campylobacter: Hlutfall jákvæðra eldishópa kjúklinga (heil lína) og þróun þeirra (brotalína) milli ára



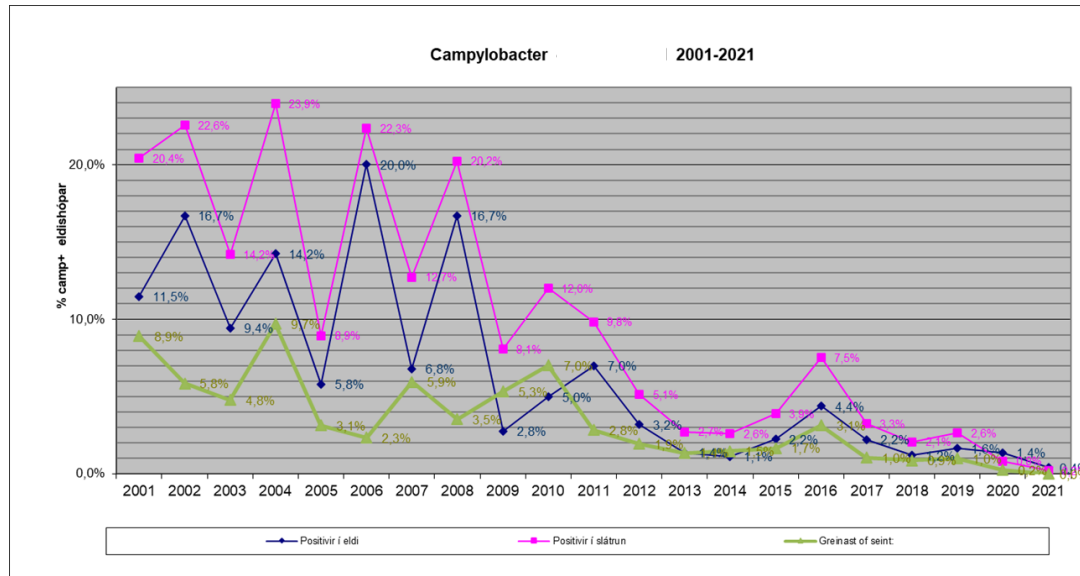
Producer A – “What we have learned”

- Combined effort resulted in lowering Campylobacter contamination
 - Stick to good working ethics
 - Set strict hygienic rules and make sure they are followed
 - Insect netting (during the summer months) makes a difference
- More years with few Campylobacter positive flocks
 - Reducing environmental reservoir
 - Helps to lower contamination even more

Producer A - *Campylobacter* trend (2001-2021)

% camp+ breeding lots

- Last 3 years **no** contaminated meat has entered shops
 - **Blue** – Positive **pre-slaughter** samples
 - **Pink** – Positive **first at slaughter**
 - **Green** – *Campylobacter* detected **“to late”**
 - Contaminated product fresh on market



Is the Icelandic model reproducible?

- Doubtful ?
- Iceland sparsely populated
 - Poultry producers – few and far between
 - Poultry slaughterhouses - only 3
 - Easy to control things,
 - Few decision layers and contact lines
- Cool climate – extreme weather
 - Cold months – little *Campylobacter*
 - Buildings have to be strong and tightly closed
 - “Outdoor happiness” not a possibility
 - Insects not abundant compared to other countries
 - Environmental load not high
- But – you never know what **economical benefit** could lead to

Thank you for your attention

