IAFP's European Symposium on Food Safety
S6 – Determining the Efficacy of Control Measures against foodborne viruses

The trouble with Hepatitis E virus!

05/04/22
Prof Linda Scobie
History of Hepatitis E virus

- First recognised as responsible for an outbreak in New Delhi in 1955
- Recognised as non A non B hepatitis in 1980s....
- In 1990s classified as new hepatic virus - Hepevirus
Genotypes

Why is it important?
Transmission Routes
Every year there are an estimated 20 million HEV infections worldwide, leading to an estimated 3.3 million symptomatic cases of hepatitis E. WHO estimates that hepatitis E caused approximately 44 000 deaths in 2015 (accounting for 3.3% of the mortality due to viral hepatitis).
Figure 3.2. Annual number of confirmed cases of hepatitis E by year of commencement of surveillance, EU/EEA Member States, 2005–2015 *

* Data available for: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Finland, France, Germany, Hungary, Italy, Latvia, the Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom.

Why is it important?

Links to the food chain
One in ten sausages may carry the hepatitis virus: Cases of rare deadly strain have rocketed 40% in a year

• Once considered very rare, cases have risen by nearly 40 per cent in a year
• 1 in 50 of those infected will die, rising to one in five pregnant women
• Sausages most dangerous pork product - they contain liver meat

By SOPHIE BORLAND FOR THE DAILY MAIL

As many as one in ten sausages could be infected with a potentially deadly virus that causes liver damage, scientists warn.

They are concerned that rising numbers of Britons are being struck down with hepatitis E after eating contaminated pork.

The infection was once considered very rare but cases have risen by nearly 40 per cent in a year and there were 657 in 2012.

The virus usually causes only relatively mild symptoms such as sickness, a temperature and muscle pain, which clear up by themselves within a month.

But it can be fatal for the elderly, cancer victims, pregnant women and others with existing liver problems.

Around one in 50 of those infected will die, rising to one in five pregnant women.

Experts say sausages have to be cooked at 70C (158F) for at least 20 minutes to kill the virus but they say that most Britons do not leave them in the oven for this long.

Tests have showed that it can survive at 60C (140F) after an hour.

A report published last week by the Department for Environment, Food, and Rural Affairs says 10 per cent of sausages sampled were found to contain the virus.

It states that there is 'increasing evidence' that hepatitis E is a food-borne infection.
Evidence of Foodborne Transmission

- First identified in Japan – undercooked Sika deer meat
- Wild boar - pig liver - Japan
- Pig liver sausage – France
- Pork meat - Spain
What foods have demonstrated detection of HEV?

- Pork Products
- Bivalve Molluscs
- Fruit
- Leafy vegetables

Is there evidence of infection via foodborne transmission?
Hepatitis E

Last updated: 13 November 2014

Following some consumers’ concern about hepatitis E in pork, the following advice is available.

Consumers should continue to follow FSA cooking advice which is that all whole cuts of pork, pork products and offal should be thoroughly cooked until steaming hot throughout, the meat is no longer pink and the juices run clear.

One study has suggested heating pork to a core internal temperature of 71°C for 20 minutes is necessary to completely inactivate the virus, however we do not know enough about the levels of hepatitis E virus present in pork more generally to say whether cooking for that long is necessary. Furthermore, cooking under these conditions may not be practical because of the effect on the quality of the meat. There is very little information available on the survival of hepatitis E virus in relation to cooking and not enough evidence to justify a change to FSA advice.

The FSA will shortly be commissioning further research to assess the impact of different time and temperature combinations on the survival of the virus in meat during cooking. The FSA would seek advice from the Independent Advisory Committee on the Microbiological Safety of Food before making any changes to our current cooking advice concerning pork and pork products.
Control measures for HEV

Surrogates

Diagnostics

Thermal stability

Disinfection/Hygiene

Infectivity determination

Risk
Surrogates

Do other viruses behave like HEV?
Control measures for HEV

Issues with current assays for diagnostics and beyond.

Isolation and Extraction
Adequate controls for extraction and detection
Need for SPCV suite for all assays
WHO HEV standard virus (sustainability)

Detection
Qualitative vs Quantitative
Infection linked to viral titre
Titres can be too low to quantify accurately

Sensitivity and specificity
Costs
What is available for diagnostic detection of HEV?

Altona

Ceeram

Gensig -PrimerDesign™
http://www.genesig.com/products/9277
What else is available for diagnostics?
Microbiology of the food chain: determination of hepatitis E virus in meat and meat products, and liver and liver products, using real-time RT-PCR

Inception meeting held on 12th January 2022

2nd meeting to be held on the 16th May
Santiago, Spain (ISFEV 2022)
Control measures for HEV

Issues with current assays for diagnostics and beyond.

Alternative assays?
Capsid integrity
Ribo/Toehold switches
No consistent assay/detection system for infectious virus
The problem with cell culture!

What is the difference between detection of NA and infection?

Outstanding issues

How do we test for infectious virus?

How much virus is infectious?

Does a food matrix affect viral replication?

What is the viral content of a food matrix and does this matter?

Figure removed as unpublished data
Source origin of HEV

- Sera, Faeces, Liver, Cell culture.

What about quasi-envelope?
HEV stability and susceptibility

- HEV inactivated at >71°C for 20 minutes
- Carbohydrate and fat composition of foods may contribute to thermal stability of HEV
- Unknown how long HEV can persist in the environment
Thermal Stability of HEV

Serum

Cell culture

Faeces

≤ 1 log

Serum
Disinfection/Hygiene

- Acid resistant – enhances stability
- Cold smoking does not eliminate virus
- Evidence of chlorine reducing viral titre in water sample
- Unknown how long HEV can persist in the environment

Behrendt et al; Journal of Hepatology 2022
Joint FSA/EFSA workshop held in Feb 2016

Key priorities established for research on foodborne viruses

How we tackle norovirus, hepatitis A and E viruses was the focus of a joint FSA/EFSA workshop that published its summary report today. The report identifies cross-cutting research themes, building on the first report of the FSA’s Chief Scientific Advisor which highlighted that foodborne viruses have a significant impact on public health.

New research is now needed to measure the infectivity of norovirus and hepatitis A and E viruses – particularly in foods, the report concludes – and how the presence of norovirus in food relates to the public health risk is one of the top research priorities for scientists.

Assessing the public health impact

The workshop, held at the Royal Society in London in February, brought together academics, regulators, consumers, veterinarians, food industry specialists and regulators to consider public health impact from these viruses - and the liability of research to deliver benefits as the main criteria when deciding on the top research priorities.

Dr Paul Cook, FSA Head of Microbiological Risk Assessment, said: “Addressing these research areas identified by the experts at the workshop would make an important contribution to assessing as well as managing risk posed by these viruses in foodstuffs.

“This is a particular challenge for norovirus, which cannot be cultured in the laboratory despite many efforts to do so; hepatitis E virus has also proved difficult to culture.”

Shortlisting the research priorities

https://www.food.gov.uk/news-updates/news/2016/15612/key-priorities-established-for-research-on-foodborne-viruses

Five main research priorities identified

The development and validation of direct and indirect methods for assessment of hepatitis E virus infectivity;

Establishing how the detection of norovirus in foodstuffs relates to public health risks;

Development of methods to evaluate norovirus and hepatitis A infectivity from food samples;

Development of standard methods and ISO methods for detection of hepatitis E virus in meat and meat products;

Establishing the burden of hepatitis E virus infections in humans in Europe.
What are we still missing?

- The development and validation of direct and indirect methods for assessment of hepatitis E virus infectivity.

- Development of standard methods and ISO methods for detection of hepatitis E virus in meat and meat products.

- Establishing the burden of hepatitis E virus infections in humans in Europe.
Thank you for your attention

Any questions?