VIRUS UPDATE BSA TECHNICAL MEETING

Annette Sansom 13th June 2023



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WHAT ARE VIRUSES?



Basically:

Genetic material surrounded by a protein coat

They are very small (25 – 40nm)

This means:

They are obligate intracellular parasites This also means:

They cannot replicate in food (only in host)

However: They survive very well in the environment including food & are difficult to remove





VIRUSES OF CONCERN CHARACTERISTICS



NOROVIRUS

Type <u>Non-e</u>nveloped, RNA virus

Genogroup I & II cause human illness

Symptoms

- Vomiting, diarrhea, abdominal pain, fever, nausea, headaches and dehydration
- Asymptomatic infection

Rapid onset

- 12 -48 hours
- Self limiting lasts 24 72 hours

Shred in large quantities (reports of $> 1 \times 10^9$ particles/g)

Infectious dose – reported to be as low as 10 particles





HEPATITIS A VIRUS

All Hepatitis viruses are different virus types that target liver cells

Type Non-enveloped, RNA virus

Genogroup I, II, & III associated with human illness

Symptoms

- Jaundice, abdominal pain, fever, nausea, vomiting
- Acute liver failure in elderly

Incubation Period

- 2 6 weeks
- Illness can last for many weeks or months





HEPATITIS E VIRUS

Type: Non-enveloped, RNA virus

7 genotypes – genotype 3 affects pigs and humans, Infection may be:

Asymptomatic, acute and self limiting or chronic

Can lead to post viral neurological conditions

Symptoms include

Jaundice, abdominal pain, nausea, vomiting

Acute liver failure in severe illness

Risk factors for complicated or serious infection

Male, elderly, pre-existing liver condition

Pregnancy

Mortality 1 – 3%*

Incubation Period 2 – 8 weeks





TRANSMISSION ROUTES





Transmission routes from people for enteric viruses



UK ESTIMATES OF FOODBORNE ILLNESSES - NOROVIRUS

Numbers of foodborne illnesses in the UK has more than doubled.

The FSA performed a scientific review*: ~2.4 million cases each year (up from 1 million in 2009)

Reportedly not an increase in total illness or any new risk, but a better estimation of numbers.

Norovirus has the largest estimate: 383,000 cases per year, up 19% from the 2009 estimate of 73,000

- Eating out: 37% of cases
- Lettuce at retail: 30% of cases
- Takeaways: 26% of cases
- Raspberries at retail: 4% of cases
- Oysters at retail: 3% of cases



*Published Feb 2020

FSA Rank Pathogens of importance in UK

Table 5 - Performance matrix showing the data for all six criteria

Pathogen	Annual Number of Cases	QALY per Case	Total Cost to Society (£)	Annual Number of Fatalities	Scientist Confidence	Public Concern
Campylobacter	299,392	0.26	712,648,487	21	Moderate	Moderate
Cl. perfringens	84,854	0.00	101,504,586	25	Low	Low
E. coli O157	468	0.06	3,924,758	1	Moderate	High
Listeria monocytogenes	162	4.03	37,381,154	26	Moderate	High
Salmonella	31,601	0.21	212,022,034	33	High	High
Shigella	1,634	0.03	12,292,279	0	Low	Very Low
Cryptosporidium	2,072	0.02	2,104,944	0	Low	Very Low
Giardia	13,142	1.01	74,999,465	0	Low	Very Low
Adenovirus	12,454	0.67	48,749,928	0	Very Low	Very Low
Astrovirus	2,552	0.67	9,988,141	0	Low	Very Low
Norovirus	383,182	0.67	1,678,156,534	56	Moderate	High
Rotavirus	2,065	0.67	8,536,199	0	Low	Very Low
Sapovirus	43,621	0.67	169,527,829	0	Low	Very Low

https://www.food.gov.uk/sites/default/files/ media/document/prioritising-foodbornedisease-with-multicriteria-decision-analysisreport.pdf Ranked on detrimental effect to society using 6 different criteria Estimated no. annual cases Quality Adjusted Life Years Public concern Total cost to society Estimated no. annual fatalities Scientist confidence







DETECTION BY PCR

Methods available to detect NoV, HAV & HEV from foods

Detects if the genetic material for the target virus are present in the product and relies on 3 main steps

- Extraction of virus from food
- Extraction of virus genetic material from virus
- Detection of the virus genetic material

Standard method is for detection of HAV & NoV from food, water & surfaces – ISO 15216-2 2019

Campden BRI offers this testing

There is not a standard method currently available for HEV detection :

FSA project – Optimising extraction & RT-qPCR-based detection of hepatitis E virus from pork meat & pork products

Campden BRI has a in house method







BUT ARE THEY STILL INFECTIVE.....



CONTROL STRATEGIES



ASSESSING VIRUS CONTROL MEASURES

Many viruses that infect humans relevant to the food industry are currently unculturable or difficult to culture

- They may be dangerous to handle & require specialist laboratory conditions
- This can provide hurdles to assess and validate effectiveness of virus control measures
- Could use other "non-human infectious" viruses similar in structure, size to provide a method of assess infectivity
- Enabling assessment of virus control measures
- These "surrogate" viruses can be:
 - Non-human mammalian viruses e.g. Murine norovirus (MNV) Feline calicivirus
 - Bacteriophage
 - e.g. MS2, Phi X174, Phi 6





VIRUS CONTROL — RESEARCH AT CAMPDEN BRI

 Increase understanding of the "survival" and "stability" of infective virus particles in food products and environments

Establish the effects of food safety control measures on the infectivity of viruses

- Intrinsic (pH, aW)
- Extrinsic (storage temperature)
- Decontamination processes (Heat treatments, produce decontamination technologies, environmental decontamination, air cleaning systems, effectiveness of disinfectants and cleaning strategies)



VIRUSES AT CAMPDEN BRI

Bacteriophage:

MS2 – nonenveloped RNA virus

Phi X174 – nonenveloped DNA virus

Phi 6 – enveloped RNA virus

Mammalian viruses:

Murine norovirus (2 strains) non-enveloped RNA virus

Feline calicivirus - nonenveloped RNA virus

Adenovirus (type 5) – nonenveloped DNA virus

Vaccinia virus Ankara – enveloped DNA virus

Coronavirus 229E – enveloped RNA virus

Mammalian viruses

(method development)

Hepatitis A HM-175 – non-enveloped RNA virus

Influenza A virus H3N2 – enveloped RNA virus







OVERALL

- Viruses can be transmitted by foods
 - Pose significant health risks and can lead to outbreaks of illness
- Viruses need to be included is risk assessments and food safety management plans
- Campden BRI can help:
 - Research program looking at control strategies for viruses
 - Verify effectiveness of virus control measures
 - Tests for detection of viruses in food, water and the environment
 - Advice for food safety management plans



THANK YOU FOR LISTENING

QUESTIONS?

Annette.Sansom@Campdenbri.co.uk

