Food Standards Scotland

For safe food and healthy eating

NOROVIRUS
INFORMATION AND GUIDANCE

2019

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1. Key norovirus Information

Common sources	Fresh salad leaves, fresh vegetable salads, soft berries and shellfish (e.g. oysters, clams)
Transmission mode	Person to person, ingestion of contaminated foods or water
Occurrence	All individuals can become ill from norovirus infection, however infection rates are highest in young children or older adults
Reservoir	Humans
Incidence of disease in Scotland	Approx. 2,000 cases per year reported
Symptoms	Nausea vomiting, watery diarrhoea, rarely fever and flu-like symptoms
Time between catching an infection and symptoms appearing	10-50 hours
Duration of illness	Average of 2 days
Infectious period	Do not prepare food at least 2 to 3 days after recovery
Prevention tips	• Practice proper hand hygiene • Wash fruit and vegetables • Cook seafood thoroughly • Clean and disinfect contaminated surfaces • When you are sick, do not prepare foods or look after others

2. Norovirus

Norovirus (formerly called “Norwalk-like virus”) is a non-enveloped, single stranded RNA virus that has been classified in the family *Caliciviridae*. Norovirus is a viral infection resulting in vomiting and diarrhoea. Norovirus is highly contagious and the commonest cause of gastroenteritis worldwide[1]. Norovirus is shed in huge quantities in the stool and vomit of infected persons and oral exposure to only a few particles is sufficient to cause disease. It can be spread from person-to-person, by consumption of contaminated food and water, or by contact with contaminated surfaces and objects[2]. Due to the high rate of secondary transmissions, small initial foodborne events may rapidly present like person-to-person outbreaks, if the initial introduction event was not recognized.

3. Growth and survival characteristics

Norovirus is a small round particle (27-38nm in diameter), and is a non-enveloped, positive-sense RNA virus. The human norovius genome is 7.5Kb in size and encodes three open reading frames (ORFs): ORF1, ORF2 and ORF3[3]. There are at least five genogroups (GI-GV), which are further divided into at least 35 genotypes[4]. Strains of three genogroups, GI, GII and to very limited extent, GIV, are found in humans[5], and GIII and GV strains are found in cow and mouse respectively although zoonotic transmission of these strains has not been observed. However, genogroup GII genotype 4 (GII.4) accounts for the majority of acute gastroenteritis outbreaks characterized worldwide[6]. This is because unlike some norovirus types, these viruses have been shown to be able to bind to a broader range of carbohydrate targets which results in having a large susceptible target population[7].

As the human norovirus cannot be grown reliably in culture, a variety of approaches have been tried to determine the survival characteristics of this virus[8]. Taken together, studies indicate that norovirus can survive for long periods in the environment. One study found that the human norovirus could remain infectious for up to 28 days on stainless steel and polyvinyl chloride surfaces at ambient temperature[9].

[1] Marshall JA and Bruggink LD. 2006. *Clin. Labor*.**52**:571-581.
[2] Said MA *et al*. 2008. Clinical Infectious Diseases. **47**: 1202–8.
[3] Clarke IN and Lambden PR. 2001. *Novartis Found Symp*. **238**:180-91.
[4] Zhen DP *et al*. 2010. *J. Clin. Microbiol*. **48**:168-177.
[5] Zheng DP *et al*. 2006. *Virology.* **346**:312-23.
[6] Rajko-Nenow P et al. 2013. *Appl. Environ. Microbiol.* **8**:2578-2587.
[7] Adamson AE *et al*. 2007. *J. Clin. Microbiol*. **45**:4058-4060.
[8] Koopmans M. 2008. *Curr. Opin. Infect. Dis*. **21**:544-552.
[9] Lamhoujeb S., Fliss I., Ngazoa S.E., Jean J. 2009. *Food Environ. Virol*. **1**:51-56.

4. Sources and routes of transmission

Norovirus is a highly contagious and highly transmissible virus. It just needs a very small number, as few as 18 viral particles of norovirus on food or hands, to cause infection of susceptible individuals[10]. The virus can spread through multiple transmission routes, with person-to-person and foodborne contamination being the most common types.

Norovirus can be found in stool (faeces) even prior to feeling sick and up to two weeks after recovery (longer in some individuals). Individuals can be infected with norovirus by accidentally ingesting stool or vomit particles from infected people. This usually happens by:

- eating food or drinking liquids that are contaminated with norovirus
- touching surfaces or objects contaminated with norovirus then putting their fingers in their mouth or
- having contact with someone who is infected with norovirus (for example, caring for or sharing food or eating utensils with someone with norovirus illness).

Norovirus does not multiply in foods, but may persist for extended periods of time as infectious particles in the environment, or in foods.

5. Human disease symptoms

Common symptoms of viral gastroenteritis include nausea, diarrhoea, vomiting and abdominal cramps. Other symptoms may include flu-like symptoms, such as, headache, chills, low grade fever, muscle aches and tiredness. Illness usually begins between 12 to 48 hours after exposure to the virus and the symptoms may last between 1 to 3 days. However, some people may be unwell for a longer period. These symptoms can lead to dehydration, especially in young children, older adults and people with other illness. Symptoms of dehydration are a decrease in urination rate, dry mouth and throat and feeling dizzy when standing up.

Anyone can get infected with norovirus and become ill. The norovirus genome undergoes frequent change and there is evidence that some of these changes are alter viral infectivity[11]. For this reason, people can get norovirus illness multiple times in their life.

Asymptomatic norovirus infection is common with approximately 16% of the population shedding the virus in the absence of symptoms[12]. This highlights the necessity for all persons involved in food production and handling to be scrupulous in employing good hygienic practice at all times.

Human disease incidence

Surveillance of norovirus is challenging largely because most people who are infected do not contact the health care services for a diagnosis.

[10] https://www.cdc.gov/norovirus/about/transmission.html
[11] Marshall JA and Bruggink LD. 2011. *Int. J. Environ. Res. Public Health*. **8**:1141-1149.
[12] Amar C.F et al. 2007. *Eur J Clin Microbiol Infect Dis*. **26**(5): 311-323.

In 2016, 1549 cases were reported in Scotland which was an 11% increase from the previous year. This data is published by HPS and can be accessed by this link: http://www.hps.scot.nhs.uk/resourcedocument.aspx?id=6217
The number of reports in 2016 was lower than the five-year average of 1847. The report also showed a distinct age distribution affecting the elderly and young, with 54% (842/1549) reported from those aged 65 years and over, 23% (364/1549) from those under five years of age, while none of the other age bands accounted for more than 4% of reports.

6. Foodborne outbreaks

During 2014, 137 general outbreaks were reported which was 82% of the total infectious intestinal disease cases in Scotland.

Norovirus outbreaks affect all age groups and commonly occur in nursing homes, hospital wards, care centres, schools, cruise ships and restaurants[13]. Most norovirus outbreaks occur in winter, but infections can occur at any time of year. Foodborne and waterborne outbreaks of norovirus have been associated with consumption of food products and water sources becoming contaminated by an infected person and then another individual ingesting virus after coming into contact with that source. Infected food workers are frequently the source of outbreaks, often by touching ready-to-eat foods with bare hands before serving. Health Protection Scotland (HPS) monitor and report on foodborne outbreaks and more information can be found through their website: http://www.hps.scot.nhs.uk/ewr/index.aspx

7. Legislation

Apart from the general hygiene legislation and some control measures for certain products including bivalve shellfish, no specific EC legislation including microbiological criteria exists for viruses in food.

In any food business, food law and general hygiene of foodstuffs legislation needs to be followed. Point 3.(a) of Article 4 (General and specific hygiene requirements) to Regulation (EC) No 852/2004 on the hygiene of foodstuffs stipulates that food business operators (FBOs) must comply with microbiological criteria for foodstuffs, which is set down in Regulation (EC) No 2073/2005. Norovirus can be frequently detected in bivalve molluscs. Regulation (EC) No 2073/2005 also indicates that criteria for pathogenic viruses in live bivalve molluscs should be established when the analytical methods are developed sufficiently. Furthermore, Regulation (EC) No 853/2004 provides a possibility to lay down additional health standards for live bivalve molluscs including virus testing procedures and virological standards. Regulation (EC) No 854/2004 Article 6 requires bivalve molluscs to be monitored and classified according to their *E.coli* content.

[13] Bruggink L *et al*. 2010. *Intervirology*. **53**:167-172.

Links to relevant regulation:

- Regulation (EC) No 2073/2005 on microbiological criteria for foodstuffs - http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02005R2073-20170101
- Regulation (EC) No 852/2004 on the hygiene of foodstuffs - http://eurlex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02004R0852-20090420
- Regulation (EC) No 853/2004 laying down specific hygiene rules for food of animal origin, include live bivalve molluscs –
- http://eur-ex.europa.eu/legal-content/EN/TXT/?qid=1503913655953&uri=CELEX:02004R0853-20160401
- Regulation (EC) No 854/2004 laying down specific rules for the organisation on official controls on products of animal origin intended for human consumption - http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2004:226:0083:0127:EN:PDF

8. Control in the food chain

Although norovirus has been detected in cows, mice and dogs, these virus strains appear to be highly species-specific and zoonotic transmission does not seem to be common. In humans, the virus typically spreads directly via person-to-person transmission or indirectly through foodborne and waterborne transmission. Food may be contaminated with virus at different steps in the food chain from primary production, to food processing, over retail (point of sale) to point of consumption, depending on the food commodity and methods of production. However, the majority of foodborne norovirus illness is a result of contamination by infected food-handlers during preparation. Food handlers with clinical symptoms of gastroenteritis should be excluded from food handling and should not be present in the primary production area, so as to reduce the likelihood of transmission of norovirus. Guidelines have been produced by the Codex Alimentarius Commission on how to control viruses in food called Guidelines on the application of general principles of food hygiene to the control of viruses in food.

Key points that food handlers/consumers should be aware of in order to reduce the chance of norovirus infection are:

- Wash hands carefully with soap and water especially after using the toilet, and before preparing food or consuming it
- Carefully wash fruit and vegetables before preparing and eating them
- Cook seafood (such as oysters and clams) thoroughly before eating them
- Staff who have norovirus symptoms should stay at home until at least 48 hours after any symptoms have stopped
- Increase the frequency of cleaning and disinfection of high-traffic areas and implicated areas

9. References

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