Journal of Biotechnology Research Center
Vol.15 No.1 **Published Online: Jun. 2021** **P-ISSN: 1815-1140**
DOI: https://doi.org/10.24126/jobrc.2021.15.1.598 **E-ISSN: 2708-1370**

Areview of the Common Food-borne Viruses

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Received: 8 / Nov. /2020 , Accepted: 11 / Mar. /2021

Abstract

Food is fundamental for the survival of all living forms. Sometimes, food gets contaminated by different types of microbes, such as bacteria, viruses, protozoa and helminthes, at any stage of food chain. Foodborne pathogens can cause life threatening infections especially in children, elderly immune compromised individuals, and pregnant women. In current years, many viruses have been defined known as main sources of foodborne diseases. Among these, Hepatitis A, HepatitisE, Rotaviruses etc.The aim of the study was to investigate on common food borne viruses, foods that transmitted them, symptoms that appear on infected people & protection methods.

Viruses are transmitted via food, water, inanimate objects and person-to-person contact.The significance of foodborne viruses is progressively more documented as causes of infection in humans. People usually acquire infection orally, after swallowing of polluted foods throughout processing, handling or preparation. Each type of foodborne viruses initiated from the personal gut, and pollution of food happens either by an infected food handler throughout preparation or by contact with sewage or contaminated water. Numerous outbreakes of foodborne viral disease are related with the pollution of ready for consumption foods via the infection of food handlers.

Key words: Common, Food borne viruses, Hepatitis A virus, Norovirus , Hepatitis E virus, Rotavirus.

Introduction

Viruses are small acellular microorganisms; all viruses containing just one type of genome.They cause several illnesses for humans, plants and animals. Viruses are obligated intracellular parasites. Their reproduction is completley dependent on the host; they unable to proliferate outer the host. Many viruses can be present in human intestine, but just a few are frequently known as main foodborne germs. (1). Acutual food-related pathogens are normally transmitted by foods, while another's pathogens are able to be transmitted via some various ways as well as to food. The Hepatitis a virus and norovirus are presently represent as the most important human foodborne pathogens with respect to the numerous of outbreaks inside to individuals affected in the living world. Food-related viruses are increasingly re as a significant food safety threat and are now reported to be responsible for most outbreaks worldwide (2). Viral diseases through contaminated food are dependent on: Viral stability, amount of virus, method of processing of food or water, stability of virus, susceptibility of the host. And dose required to occur infection almost all food- or waterborne viruses are nacked and are approximately resistant to heat, alters in pH and disinfection. Food or water contaminated with virus will appearance, odor, and flavor usual and that seem problems in the detection of the contaminated products (3). Viruses causing foodborne infection adhere to cells of the gastrointestinal canal and proliferate interior them; consequently they attack more cells of the alimentary canal or arrive to more parts of the body such as CNS or liver (1) and cause illness. Contamination of food with viruses can happen during primary production, processing and preparation. Contamination mainly occurs when foods contaminated with human faeces. Ready-to-eat foods and raw consumed foods, such as shellfish and fresh produce, are commonly related to foodborne viral outbreaks. Foodborne transmitted viruses append to many various families and the illness a companied with their infection may vary from moderate diarrhea to serious neurological diseases, lax palsy, with steady in frequent happening of myocarditis, respiratory illness or haemorrhagic fever. However, nearly all accounted foodborne conditions are hepatitis and gastroenteritis. The main genera associated with

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foodborne viral illnesses are Astrovirus, Enterovirus, Hepatovirus, Norovirus, Rotavirus, Sapovirus and members of the family Adenoviridae (4). Pathways of transmission of foodborne viruses include food contamination by handlers of food infection, pollution of food through the manufacturing process and by ingestion of results of animal source housing a zoonotic virus. Almost all foodborne outbreak illness throughout the world related in Hepatitis A virus, Norovirus and Rotavirus, which can be transferred by the fecal/oral way, either by direct junction with infected persons or by consumption of polluted foods and water, like vegetables, fruits, bivalve molluscs and shellfish. (1). In this review, we will inscribe common diseases caused by foodborne viruses, which have be an important reason for all notified foodborne diseases in current times and knowing as an emergent hazard pathogens.

1- Hepatitis A Virus (HAV)

Hepatitis A virus (HAV) belongs to the genus Hepatovirus, which is belong to Picornaviridae family, the major vehicle of HAV transmission is individual-to- individual the most common vehicle; however, foodborne infections may happen periodically. Hepatitis A outbreaks related to food are less common than norovirus (5)**.** Hepatitis A is endemic (commonly occurs) in underdeveloped countries**.** Infections result in life-long immunity; generally children become infected early in life and therefore serious infections in adults are rare. In contrast, in developed countries, HAV incidence is low due to sanitization practices of a relatively higher standard, leaving adults more susceptible to infection. Immunization may also decrease viral shedding (the release of viruses of the next generation) and consequent contamination and infections (6). Current instruction for foods at hazard of HAV contamination (such as oysters from contaminated areas, or berries imported from HAV-endemic countries) is for heat treatment that exceeds 90 °C for 90 seconds or more. Foods of initial significance, because of, those vulnerable to pollution through the making stage, like mollusks bivalve (clams, mussels, oysters) or produce that is moisten with water that may be contaminated such as: loose fruits, (e.g. strawberries and raspberries), lettuce, green onions.

The prevalence of HAV disease differs significantly through the nations. In most growing nations, where hepatitis A infection is endemic disease, the greater number of peoples are infected in early children stags, when the infection is commonly asymptomatic. Actually whole adults are protected. HAV infections in developing nations are minimal wide spread, duo to developed standards in these countries. a small numbers of individuals are infected in early stages of childhood, while the greater numbers of adults stay vulnerable to HAV infection. For this reason, the potential hazard of HAV spreads is raised in these places (7).

HAV is usually identified in foods using PCR-based methods. Some HAV strains have been isolated and shown to produce cytopathic effects (structural changes in host cells, caused by infection) in monkey kidney cell lines, which allows detection of some strains using quantitative plaque assays (8). Plaque assays are used to measure the concentration of a virus present, highly exactly. This has permitted valuations of the infectivity of HAV following certain food processing treatments to be undertaken, including high pressure processing, heating (9).

HAV can be spread individual-to- individual, or via polluted food and water, specially fruit or eating meals with no further cooking required to disable the virus. HAV is completely stabilized outside a host cell also, for that reason, can remains on polluted habitats, water as well as food.

HAV virus causes an acute infection, symtoms developing gradually by fever, malaise, anorexia, nausea, vomiting, deep urine, ventral pain and jaundice (yellowish discoloration of the eyes or skin). The incubation period is between (15 and 50) day، and illness usually persists less than two months. The disease is more severe in adults than young children, making outbreaks more problematic in developed countries with non-immune adults (10).

Viral reproduction happens in the liver. Virions (complete infectious viruses, free of host cells) reach the gastrointestinal tract in bile and are then sheded in faeces (11). The main transmission is faecal–oral route; though, other forms of transmission can occur, including by the parental route and through sexual practices (10). Up to

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1011 genome copies/g faeces have been detected in patients who have shed the virus for up to 6 weeks (12). Thus, food primarily becomes contaminated with HAV through poor hygienic practices. Both symptomatic and asymptomatic (symptomless) carriers shed virus and, of high concern to food production, secretion of virus begins before the beginning of symptoms. The infectious dose of HAV is not known but has been supposed to be around (10 to 100) virus particles (12). Decease may occur, especially in the elderly persons, but is quite seldom. Great counts of virus molecules can be disposed in the urine and stools throughout the last part of the incubation time, prior jaundice is obvious, but they are ordinarily away seven days next the beginning of jaundice.

2- Norovirus

Norovirus (NoV) is a genus within the family Calciviridae, and they include a group of viruses that mainly cause gastroenteritis. NoV (previously called as small round structures viruses (SRSVs) or Norwalk-like viruses (NLV)) .In Ireland there are between 1,000 and 2,000 announcements (outbreaks) of NoV disease yearly {Health Protection Surveillance Centre(13). In the UK (NoV) is the most common cause of intestinal disease and is assessed to be responsible for three million cases yearly (14). NoV infections lead to disease in human of all stages. Disease generally is approximately mild, but more serious disease and decease arises in hazard categories like the elderly or human with fundamental illness. Transmission of NoV frequently occurs directly from person to person, with estimates of foodborne spread , one recent study suggests that around 14% of all outbreaks are attributed to food (15). Though, recognizing foodborne outbreaks is not always easy and this may describe why some variability is observed between countries in the proportion of outbreaks ascribed to foods (15). Documentation of contaminated foods as a cause of outbreaks is mainly challenging when consumers share meals, and is made even more hard by absence of analytical ability in some countries. Noroviruses are divided into seven genogroups (GI to GVII) based on variations in the capsid proteins. Noroviruses infect a variety of animals, including humans (genogroups GI, GII and GIV), pigs (GII), cattle and sheep (GIII), dogs (GIV, GVI and GVII) and mice (GV) (16). Noroviruses are small (27 to 32 nm), non-enveloped. The genome consists of single-stranded, positivesense RNA (meaning it can be translated into protein in the host cell) that is around 7.6 kb in length.

Noroviruses are very vigorous, continue for long periods in the habitats as well as resistant for many common food industries. They are among the most infectious pathogens t a few particles may induce pathogenesis, or disease .Really, to happen the infection the virus wants to bind to specific polysaccharides of the histo-blood group type and, due to their genetic diversity, they can infect all humans (17). Norovirus was not able to be cultured for a long time. Newly a culture method based on enteroids miniorgans, or organoids , created in the research laboratory from intestinal cells has been developed but this cannot be used usually until now. Therefore, NoVs are distinguished in foods using genomic detection methods. The absence of a culture method has meant that studies on food processing techniques that aim to inactivate NoV generally use culturable alternate viruses such as mouse NoV.

Foods generally play a role in Norovirus spreads are raw fruits, shellfish and leafy greens like lettuce. Nearly all foodborne NoV spreads happen in meal supply locations such as restaurants (18). Infections of food handlers can transfer NoV by affecting foods be eaten immediately, like vegetables and fresh fruits, or undercooked meals, inadequately washed hands. Food can be contaminated by NoV through navigation, production, treating or preparation. NoV spreads can initiate from defecation of foods at their source e.g. oysters collected from polluted water, surrounding sources with leafy greens, else raspberries spray-irrigated with polluted water. They have been related in a wide range of food types, but 3 groups are recently identified: (i) spreads due to infection of food handlers; (ii) spreads caused polluted by bivalve molluscs; and (iii) spreads occure by polluted yields (green onions, blueberries).

Norovirus, also known as winter vomiting disease, causes acute gastroenteritis. The incubation period is between 12 and 72 hours and illnesses naturally last for 2 or 3 days. Watery diarrhoea is the most common symptom, along with vomiting, fever, abdominal cramps,

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headaches, chills and muscle pain (16). Vomiting is common and is hypothesised to contribute to transmission of the virus through aerosolisation and general environmental distribution. Large quantities of virus are also excreted in feces, with about 10^8 genome copies per gram of feces, and up to 10^{11} in some cases (19). Excretion of virus in the feces remains after symptoms subside for up to 3 or 4 weeks, further contributing to viral spreading. Gastroenteritis mentioned to any inflammatory response of the stomachic pathway inspite of the words is generally used to refer to severe diarrhea, commonly followed by puking, queasiness and stomachache (20). NoV is currently the most important cause of severe gastroenteritis amongst kids less than five years of age who look for therapeutic care (21). Infection caused by NoV is ordinarily rapid in start and distingushed by diarrhoea, abdominal aching and vomiting. The period of the signs varies from 12 – 72 hours. Few virus units are required to cause infection, consequently the occurrence rate in an outbreak can be actual great, and the majority of individuals who ate the spoiled food becoming sick. As the viruses reproduce in the stomach, a very large number of virus units are secreted through the disease (frequently more than 10^6 per gram of feces or vomitus). As a result of the strong nature of the signs, food can simply become tainted by infected food handlers and secondary person to person spread is similarly common. The virus's abilities to tolerate a wide-ranging of temperatures from freezing to 60°C and to continue on ecological surfaces and food stuffs make a contribution to rapid spreading (22).

3-Hepatitis E virus

Hepatitis E virus (HEV), categorized in the genus Hepevirus, the only member of the family hepeviridae. HEV is commonly spread through the fecal-oral route owed to contaminated water or poor sanitation of water for manufacturing principles (23,1 ,4). Additional studies proposed other means of HEV transmission and a zoonotic probable of the virus pigs and deer as possible cause for infection for humans. HEV spread in developing countries of Africa, Asia and America. The mechanism by which the virus spread to the location of primary proliferation has not completely been explained until now. Duplication of viral units takes place in mucosa of the intestinal cells, however principal in the cytoplasm of the liver cells. Viruses are transmitted with bile from liver to intestine (24).Several clinical signs of this disease have been detected.

HEV infection is most frequently noticed in kids, young to intermediate aged adult 15-40 years old and could be severe in pregnant women. The signs of the illness in most cases involve moderately severe Hepatitis with signs of influenza- like symptoms, abdominal ache, vomiting, nausea and fever in the 1st stage of (1-10) days. While the 2nd stage from (15-40) days with simultaneous jaundice and dark urine, liver enzyme raises, antibody seroconversion and clearing of virus (25,26). HEV is categorized as one of the food-borne and water-borne viruses. Developing countries of Africa, Asia, south and middle America are considered as hazard areas (1,4).

Inadequate treatment of drinking water and animals or human fecal contamination of drinking water are common (27,23). Owing the information that most HEV illneses are transmitted by the fecal oral means. People should escape drinking water or ice of anonymous purity in addition to consumption raw shellfish and vegetable or fruits are considered as danger factors for HEV transmission (28). Zoonotic infections cause disease with HEV through interaction with animals and through tainted parts of animals that consumed e.g. milk, meat, eggs (29) another routes of HEV transmission have been recognized, these include: Eating of undercooked meat or meat products derived from infected animals,transfusion of infected blood products and vertical transmission from a pregnant woman to baby.

Food packaging and food constituents act as antiviral.

Herbal extracts have antimicrobial effects and used to control spreading of enteric viruses as natural preservation of raw and processed food (30,31). Viruses can be disabled by remedied with extracts from seeds of grape, mulberries, cranberries, balck raspberries and pomegranates.

Phenolic compounds of plant exhibited antiviral properties against Rotavirus such as flavonoids and phenolic acids (32,33). Numerous natural biochemical have antiviral effects (34). Saponin (1.0 Mg per ml) ensured inhibitory effects by

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hindering attachment of viruses to host cells. (35) Milk protein (lactoferrin) blocks Rotavirus entery into the cell (36).

The signs and symptoms of Hepatitis E virus include:

Fever, Fatigue, Loss of appetite,nausea,vomiting.abdominal pain,jaundice,dark urine,clay –colored stool, joint pain.

Identification of hepatitis E infection is commonly based on the recognition of specific antibodies like (IgM) to the virus in the blood of infected person's. Rapid testes are available which includes reverse transcriptase polymerase chain reaction (RT-PCR) to identify HEV RNA in stool and/or blood; this test needs specific facilities in the laboratory.

Treatment: There is no particular antiviral therapy for acute hepatitis E. Immunocompromised persons with chronic hepatitis E can advantage from specific treatment using an antiviral drug like (ribavirin). In some specific cases inferferon has been effectively too. Patients are recommended to break, obtain appropriate nourishment and fluids, escape alcohol and check with their doctor before taking any drugs that can harm the liver. Hospitalization sometimes necessary in severe cases (pregnant women). (37)

Prevention of hepatitis E disease depend principally on good hygiene and the availability of clean drinking water. Boiling and chlorination of water will inactivate HEV. Don't consume raw pork & deer meat, or uncooked shellfish, rinse hands with water & soap after using the toilet, replace adiaper and before you make or consume food (38). (39) In 2011, a recombinant subunit injection to stop HEV infection was recorded in China, however it hasn't been allowed in additional countries (40).

4-Rotavirus

Rotavirus (RV) is the most common cause of gastroenteritis. Rotavirus infection causes rigorous watery diarrhea, abdominal pain,vomiting& fever. It can lead to dehydration, in babies and young kids, (41) (stopfoodborne illness.org).Adluts and older kids can likewise diseased with rotavirus, but the subsequent illness is frequently less severe than that in babies and young kids. Rotavirus spreads simply amongst young kids and can similarly transmit to other family members with close interaction. RV is transfer from person's body to the ecosystem through the feces of diseased individuals , the virus spreads by the fecal- oral route (this means that the virus necessity be distributed by a diseased individual and then enter a vulnerable individual's mouth to cause infections). RV distributed by contaminated water , food , hands and matters like surfaces & toys. Symptoms of RV diseases take about 2 days to appear after the person has been exposed to rotavirus. This virus can persistent for at least 4 hours on hands of human & for weeks in drinking and recreational waters. Viruses are unaffected by hard- surface sanitizers and disinfected hand- wash means (42). Rotavirus infection is principally diagnosed by laboratory detection in fecal samples. Electron microscopy polyacrylamide gel electrophoresis, immunoassays,PCR , virus isolation and other progressive detection methods are usually employed (43).

There is no specific treatment for rotavirus. So, recommended by increased fluid intake (oral rehydration) to avoid dehydrartion, sometimes requires hospitalization for hydration with intravenous fluid .Rotaviruses are originate in discarded water and can also be intense by shellfish, however, rotaviruses have not been related with infectious diseases following seafood ingestion (44,45). RV is transferred by fecal-oral contact and by polluted surfaces, hands and breathing spread (46,47). Several species of animal are infected with rotavirus distinctive from that of the human. Rotavirus infection may develop after ingestion of infected animal's meat, or by ingestion or eaten contaminated raw fruits and vegetables (48). Food contamination after cooking can also be the source of viral infection (49,50,45).

Conclusion

Common symptoms of viral gastroenteritis involve: diarrhoea & vomiting. Asymptomatic infections are commonly observed, and play a important role in spreading the infection. Supportive care, such as oral rehydration solutions and intravenous fluids is favored for the management of viral gastroenteritis. As foodborne viruses are an emerging problem in the world , therefore highly imperative to implement

Vol.15 No.1 Published Online: Jun. 2021 P-ISSN: 1815-1140
DOI: https://doi.org/10.24126/jobrc.2021.15.1.598 E-ISSN: 2708-1370

stringent hygienic measures for preventing the contamination of viruses into food chain . Increased awareness and training of food handlers in good hygiene practices play a vital role to decrease the foodborne viral illnesses.

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Journal of Biotechnology Research Center
Vol.15 No.1 **Published Online: Jun. 2021** **P-ISSN: 1815-1140**
DOI: https://doi.org/10.24126/jobrc.2021.15.1.598 **E-ISSN: 2708-1370**

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مراجعة للفايروسات الشائعة التي تنقلها الاغذية

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الملخص

الغذاء اساسي لبقاء جميع اشكال الحياة.في بعض الاحيان يتلوث الطعام بانواع مختلفة من المايكروبات مثل البكتريا ،الفايروسات ،الابتدائيات والديدان الطفيلية في اي مرحلة من السلسلة الغذائية. الممرضات المنقولة عن طريق الاغذية تستطيع ان تسبب اصابات مهددة للحياة خصوصا في الاطفال ،الافراد كبار السن منقوصي المناعة والنساء الحوامل. في السنوات الحالية العديد من الفايروسات تم تعريفها كمصادر رئيسية للامراض المنقولة عن طريق الاغذية من بينها التهاب الكبد الفايروسي أي، وفايروسات الروتا والخ...

الهدف من الدراسة هو للتحقق من الفايروسات الشائعة المنقولة عن طريق الاغذية ،الاغذية التي تنقلها ،الاعراض التي تظهر على الاشخاص المصابين وطرق الحماية .

تنتقل الفايروسات عن طريق الغذاء ،الماء ،الاطعمة المجمدة والتماس من شخص الى اخر .ان اهمية الفايروسات المنقولة عن طريق الاغذية موثقة بشكل تدريجي كمسببات للاصابة في الانسان .الاشخاص عادة يكتسبون الاصابة عن طريق الفم ، بعد ابتلاعهم اغذية ملوثة خلال المعالجة او الاعداد. يبدأ كل نوع من الفايروسات المنقولة عن طريق الاغذية من امعاء الاشخاص ،وتلوث الغذاء يحدث اما عن طريق المتعاملين مع الاغذية المصابين خلال الاعداد او من خلال التماس مع مياه الصرف الصحي او المياه الملوثة . تفشي العديد من امراض الفايروسات المنقولة عن طريق الاغذية هي مرتبطة بتلوث الاغذية الجاهزة للتناول بواسطة المتعاملين مع الاغذية المصابين.

الكلمات المفتاحية : الفايروسات المنقولة عن طريق الغذاء، التهاب الكبد الفايروسي أي، فايروسات النورو، فايروسات الروتا.