

Microbial Analysis of Animal-Derived Foods for Enumeration of Viruses

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ABSTRACT

Animal-derived foods such as milk, meat, eggs, and fish provide humans with essential nutrition and are widely consumed across the world. These foods are rich in proteins, vitamins, and minerals. However, if proper hygiene is not maintained during production, processing, storage, or transportation, such foods may become contaminated with harmful microorganisms, including viruses. Viruses are microscopic infectious agents that cannot be seen with the naked eye. When contaminated food is consumed, these viruses may enter the human body and cause illnesses such as diarrhoea, vomiting, abdominal pain, fever, and gastroenteritis. Therefore, detection and monitoring of viruses in animal-origin foods are extremely important for ensuring food safety and protecting public health. This article explains the major methods used for viral detection in food samples, including ELISA, Latex Agglutination, RT-PCR, and Agarose Gel Electrophoresis, in simple language.

INTRODUCTION

Milk, chicken, chevon, eggs and fish are important sources of animal-derived food and are consumed daily in many households. These foods contribute significantly to human nutrition, especially by providing high-quality protein.

However, animal-origin foods are also highly perishable and can easily become contaminated if handled improperly. Lack of hygiene during milking, slaughtering, processing, packaging, or storage may allow harmful microorganisms to enter food

products. Among these microorganisms, viruses are a major concern.

Viruses that primarily infect the intestinal tract are known as Enteric viruses. These viruses are commonly associated with gastroenteritis and diarrheal diseases. They spread mainly through contaminated food and water (WHO, 2023). Foodborne viral infections have become a growing public health challenge due to increasing consumption of processed foods, expansion of food supply chains, and poor sanitation practices in food processing centers, slaughterhouses, poultry shops, and markets (FAO, 2020). Hence, routine testing of animal-derived foods for viral contamination is essential for ensuring food safety and preventing outbreaks.

Objective

The main objectives of viral analysis in animal-derived food samples are:

1. To isolate viruses from the given food sample of animal origin.
2. To identify the suspected viral agents present in the sample.
3. To determine whether the food product is safe for human consumption.
4. To prevent foodborne viral diseases and protect public health.

Principle of Viral Detection in Food

Detection of viruses in food samples is challenging because viruses are present in very low numbers and cannot grow on ordinary culture media like bacteria. Therefore, specialized techniques are required.

Two major approaches are commonly used:

1. **Immunological methods**
2. **Molecular methods**

Both methods play an important role in food microbiology laboratories.

1. Immunological Methods

Immunological methods are based on the detection of viral antigens or antibodies. These tests are simple, rapid, and widely used for screening purposes.

(A) ELISA Test (Enzyme Immunoassay)

ELISA is one of the most commonly used laboratory techniques for detecting viruses in food samples.

Principle

The basic principle of ELISA is the binding reaction between:

- Antigen (Ag) = viral protein
- Antibody (Ab) = immune protein specific to the virus

When the antibody binds to the antigen, an enzyme-linked reaction converts a colourless substrate into a coloured product, indicating the presence of viral contamination (OIE, 2019).

Dot-ELISA

Dot-ELISA is a simplified version where the sample is applied on a nitrocellulose membrane coated with specific antibodies.

Results

- **Positive:** Appearance of a brown-coloured dot
- **Negative:** No change in colour

Importance

ELISA is useful for quick screening of foodborne viruses and can be performed easily in diagnostic laboratories.

(B) Latex Agglutination Test

Latex Agglutination is another rapid immunological method.

Principle

Small latex beads are coated with antibodies. If viral antigens are present in the food sample, the beads clump together, forming visible aggregates (CDC, 2022).

Results

- **Positive:** Clumping or agglutination is observed
- **Negative:** No clumping occurs

Advantages

- Very quick test
- Simple to perform
- Useful in field-level diagnosis

Limitations

These tests are usually qualitative and may have limited sensitivity.

2. Molecular Methods (Molecular Detection Techniques)

Most enteric viruses are RNA viruses. Therefore, molecular methods focus on detecting viral genetic material rather than proteins.

Molecular detection techniques are highly sensitive and specific compared to immunological methods.

(A) RT-PCR (Reverse Transcriptase PCR)

RT-PCR is the gold standard technique for detecting RNA viruses.

Principle

- Viral RNA is converted into complementary DNA (cDNA) using the enzyme reverse transcriptase.
- The cDNA is then amplified through PCR cycles.

RT-PCR can detect even very small quantities of viruses in food samples within 24 hours (FAO, 2020).

Advantages

- Extremely sensitive
- Highly specific
- Detects low viral loads

Applications

RT-PCR is widely used for detection of norovirus, enteroviruses, hepatitis A virus, and other foodborne pathogens.

(B) Agarose Gel Electrophoresis

After PCR amplification, the DNA products must be visualized.

Principle

DNA molecules carry a negative charge. When placed in an electric field, they migrate through agarose gel toward the positive electrode. Smaller DNA fragments move faster than larger ones.

Results

- **Positive:** DNA bands match the standard ladder
- **Negative:** Bands do not match or are absent

This confirms whether the suspected virus has been detected.

Sample Collection and Virus Isolation

Testing food samples for enteric viruses is not routinely practiced for all foods due to complexity. However, it is especially important for certain commodities.

High-risk foods include:

- Shellfish and bivalve mollusks

- Raw milk
- Undercooked meat products
- Contaminated water-based foods

Bivalve mollusks can concentrate viral particles from polluted water, making them a major source of foodborne outbreaks (WHO, 2023).

Concentration Methods

Since viruses occur in very low numbers, concentration steps are required:

- Adsorption-elution
- Precipitation
- Ultrafiltration

These steps improve detection efficiency.

Benefits and Limitations of Viral Detection Tests

Benefits

- Rapid diagnosis of viral contamination
- Ensures food safety and quality control
- Helps prevent foodborne outbreaks
- Protects public health

Limitations

- Some tests provide only qualitative results
- Molecular methods require advanced laboratory facilities
- Viral detection is technically complex and costly

Method	Type of Test	What it Detects	Result Indication
ELISA (Enzyme Immunoassay)	Immunological	Viral antigen or antibody	Colour change (brown dot in Dot-ELISA)

Latex Agglutination Test	Immunological	Viral antigen-antibody reaction	Clumping of latex beads
RT-PCR (Reverse Transcriptase PCR)	Molecular	Viral RNA genome	Amplification of viral genetic material
Agarose Gel Electrophoresis	Molecular (Confirmatory)	PCR amplified DNA products	Bands visible under UV light
Adsorption-Elution / Ultrafiltration	Sample Concentration Step	Concentrates viruses from food/water	Improves detection efficiency

CONCLUSION

Viral contamination of animal-derived foods is a significant concern for food safety and public health. Enteric viruses transmitted through contaminated food and water can cause serious gastrointestinal illnesses. Modern diagnostic methods such as ELISA, Latex Agglutination, RT-PCR, and Agarose Gel Electrophoresis provide effective tools for detecting viruses in food samples. Regular monitoring and adoption of hygienic practices in food production and processing can greatly reduce the risk of foodborne viral diseases and ensure safer food for consumers.

REFERENCES

- CDC. (2022). *Foodborne viral infections and laboratory detection methods*. Centers for Disease Control and Prevention.
- FAO. (2020). *Food safety risk analysis and viral contamination in foods*. Food and Agriculture Organization of the United Nations.
- OIE. (2019). *Manual of diagnostic tests for aquatic and foodborne viruses*. World Organisation for Animal Health.
- WHO. (2023). *Enteric viruses and foodborne disease outbreaks: Public health concerns*. World Health Organization.