

Food-Borne Viral Diseases - An Emerging Problem

Ponnambalam Arun^{1*}, Padmanabhan Vidya², Kaveri Krishnasamy³

¹Research Assistant, Department of Virology, The King Institute of Preventive Medicine and Research, Guindy, Chennai, Tamil Nadu 600032, India

²Associate Professor & Head, PG & Research, Department of Microbiology, D. G. Vaishnav College, NO.833, Gokul Bagh, Poonamallee High Rd, Arumbakkam, Chennai, Tamil Nadu 600106, India

³Deputy Director and Head, Department of Virology, The King Institute of Preventive Medicine and Research, Guindy, Chennai, Tamil Nadu 600032, India

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*Corresponding author: Ponnambalam Arun

Abstract

Original Research Article

Background: Acute diarrheal diseases are one of the top five causes of morbidity and mortality worldwide, accounting for 0.52 million deaths annually in children. In India, approximately 2.5 million children were affected with diarrhoeal illness every year. Amongst these, viral diarrhoea's form the most important cluster. Rotavirus is the most common identifiable viral cause of diarrhoea in children. Rotavirus infection ranges from asymptomatic infection to severe life threatening diarrhoea. The main cause of diarrhoea are poor personal and food hygiene and lack of clean drinking water. **Materials and Methods:** Stool specimens from 100 subjects have been collected for this study from a hospital in Chennai, who presented with diarrhoea and were tested for the causative agents responsible for the infection by various microbiological techniques. **Results:** It was found that 24% of samples were positive for Rotavirus by antigen detection (24/100) (Premier Rotaclone) from samples collected due to diarrheal admissions by Enzyme Linked Immuno-Sorbent Assay. (Premier Adenoclone 40/41). **Conclusion:** Surveillance of viral food-borne pathogens has to be monitored which is generally poor in India, but emphasis is placed on Norovirus, Hepatitis A, Rotaviruses and few newly emerging viruses such as SARS from recent outbreaks and hospitalizations have been reported. FDA is framing rules for food safety and this could be achieved only if a cross cutting issue which involves both health and non-health areas such as food industry, agriculture, standardization/regulation authorities, food distributors and the general public.

Keywords: Diarrhoea, Viruses, Food Safety, ELISA, FDA.

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INTRODUCTION

Food poisoning or food-borne illness could be defined when one gets sick from in-taking of food or drink that has been contaminated. Generally poisoning is of two types, one by toxic agent or by infectious agent. When microbes infect the body after taking food is referred to as food infection and food intoxication which happens even when the microbe that produced the toxin is no longer present or able to cause infection inside the host. Food poisoning is usually caused by variety of viruses, pathogenic bacteria, fungi, prions, or parasites.

Global burden of infectious diarrhoea is estimated to be 3-5 billion cases and nearly 1.5 million deaths annually, due to contamination of food and water among young children under five years of age. Annual burden of food-borne diseases according to WHO in South East Asian Region is more than 150 million illness, 175 000 deaths reported by FERG report 2016.

Saikia *et al.*, [1] reports that food-borne outbreak diseases in India are due to *S.aureus*, *Vibrio spp.*, *Salmonella sp.*, *E.coli*, *Yersenia enterolytica*, among viruses are Norwalk like viruses, Adeno40/41, Astrovirus and rotavirus. Worldwide, foodborne illness figure among emerging and re-emerging diseases in the last few decades includes Campylobacteriosis, Cyclosporidium, Cryptosporidiosis, Entero hemorrhagic *Escherichia coli* infections, Listeriosis and Yersiniosis.

Ingestion of *Amanita phalloides* which contains amatoxin a potent cytotoxin occurs due to ingestion of mushroom poisoning by Verma *et al.*, [2] food borne infections due to high level of drug resistance has been reported from India by Mukerjee *et al.*, [3] who has isolated 166 *Campylobacter jejuni* strains due to macrolide resistance from pediatric diarrhoea cases (children < 5 years) in an hospital in Kolkatta during 2010-2012.

In some grains like rice and spices predominance of arsenic is found in inorganic forms which is real threat to human health. In Delhi in 1998 where 60 persons lost their lives and more than 3000 victims were hospitalized due to outbreak caused by epidemic dropsy food poisoning reported by Singh *et al.*, [4] India is in the midst of an epidemiological transition. While communicable diseases continue to pose a sizeable challenge in India, non-communicable diseases are estimated to account for 60% of total deaths in India in 2014. The NFHS 4 shows that the prevalence of obesity is on the rise. According to the survey, 20% males and 18% females are obese in India.

Symptoms of food poisoning includes any one or all of the following nausea, abdominal pain, vomiting, diarrhoea, gastroenteritis, fever, pain in the head or fatigue depending on the food ingested. Incubation period varies from hours to days in some cases like listeriosis it takes years to show symptoms. If the incubation period is long foodborne illnesses cause is attributed to the symptoms to gastroenteritis.

Gastroenteritis is an inflammation of the gastrointestinal tract which involves stomach and intestine. Incubation period ranges or subsides within two weeks if treated, since gastroenteritis are caused by many pathogens, most of the infections are caused by viruses, in particular rotavirus and Norwalk like viruses, Adeno 40/41 has been reported.

Rotavirus is the most common cause of gastroenteritis among infants and young children worldwide. The clinical spectrum of rotavirus illness ranges from mild, watery diarrhea of limited duration to severe diarrhea with vomiting and fever that can result in dehydration with shock, electrolyte imbalance, and death. Rotaviruses are comprised of 11 segments with double stranded RNA as their genetic material. Among various proteins and genes NSP4 plays a vital in enterotoxin which is responsible for diarrhea and this is the first viral enterotoxin discovered.

In India, Rotavirus associated (in the absence of immunization programme) gastroenteritis diarrheal deaths there is an estimation of 1, 00,000 deaths reported. Studies conducted in different parts of India have identified the prevalence ranged between 13.2 and 63%. Children under five years of age are highly affected due to low immune power where as adults are affected in low numbers because of increase in immunity attained due to age.

MATERIALS AND METHODS

This study was done among 100 children, admitted to hospitals due to diarrhea. Patients admitted for other than diarrhoea, diarrhoea obtained after hospital admission, fever for more than 14 days were excluded. Institutional Ethical Clearance was obtained. Informed consent has been obtained.

Stool Specimens

Stool samples has been collected in clean, dry, leak-proof screw cap container and taped by proper collection and transported the stool specimens in appropriate transport medium (modified Cary-Blair medium) to the laboratory for diagnosis with proper labelling of the specimen.

Handling and Transport

Stool specimens was transported in ice. Viral yields may fall significantly if specimens are not processed within 48hrs of collection since viruses are sensitive to elevated temperatures.

Detection of viruses by their Specific Antigen

Collected samples were analyzed using ELISA for rotavirus. The obtained data were analyzed using standard statistical methods in SPSS software version 21. Commercially available Premier Rotaclone kit along with the manufacturer's instructions has been followed for detecting viral antigen from stool samples of infected children.

RESULTS

Out of 100 samples rotavirus was detected in 24% of fecal specimens collected by ELISA among children with acute diarrhoea. p values <0.05 were considered statistically significant. The gender distribution and total number of samples collected during the study period is shown (Table-1).

Table-1: Gender Distribution of Rotaviral Diarrhoea

GENDER	TOTAL	POSITIVE
MALE	62	18
FEMALE	38	6

DISCUSSION

The globalization of food trade has increased the potential to rapidly spread foodborne hazards around the world. An error by a food producer in one country can affect the health of consumers on the other side of the planet. Strategies to ensure food safety include effective surveillance system for foodborne diseases linked to a food safety database information system; food control and inspection systems.

From an USA study which states cause of hospitalizations were due to non-typhoidal *Salmonella* spp. (35%), Norovirus (26%), *Campylobacter* spp. (15%) and *Toxoplasma gondii* (8%). Leading causes of death were non-typhoidal *Salmonella* spp. (28%), *Toxoplasma gondii* (24%), *Listeria monocytogenes* (19%) and Norovirus (11%).

In our study we have found rotavirus infections in 24% of the samples collected and we didn't investigate for bacterial agents. During 1995 England study reports of seven percent incidence per

1000 persons in a year due to food-borne disease caused by rotavirus and three percent incidence due to adenovirus40/41 and 11.5 percent due to Norwalk like virus.

Study of Canadian population from 2006-2011 admitted due to gastroenteritis caused by food infections represents thirty six percent of hospitalizations are due to rotavirus among the other causative agents which are involved in gastroenteritis due to food poisoning. Our study has percentage of

thirty three which coincides with the study done by Morton *et al.*, [5].

In Poland during 2014 25% of the affected persons had rotavirus as etiological agent for food poisoning due to rotavirus and three outbreaks. Rotavirus genotype G2 was detected from children went on for school trip from 45 out of 107 aged 10-12 years due to food-borne gastroenteritis outbreak. Our study we had children of age group 1-2 years affected than other age group of children admitted to hospital (Table-2).

Table-2: Age wise Distribution of Rotaviral Gastroenteritis in both genders

Age(months)	Mean \pm SD	Positives		Total %	
		Male (16) n=62	Female (8) n=38	Male	Female
0-12	9.41 \pm 2.14	3	2	29.4	27.2
13-24	17.58 \pm 3.35	9	4	33.3	21.4
25-36	31.46 \pm 3.75	2	1	28.5	20
37-48	43.44 \pm 3.00	1	1	25	20
49-60	57 \pm 5.01	1	-	25	-
>60	66	-	-	-	-

CONCLUSION

Food safety is an area of public health action to protect consumers from the risks of food poisoning and foodborne diseases, acute or chronic. Hazard Analysis and Critical Control Point (HACCP) is a systematic preventive approach to food safety. The rotavirus prevalence of 24% due to food poisoning makes it an important public health issue particularly in view of its significant association with the severe forms of diarrhea. Rotaviral diarrhea does not have any specific treatment and repeat infections are common.

RECOMMENDATIONS

Food safety education to prevent food-borne outbreaks by education of food-handlers and the community, Handwashing, discouraging sewage farming for growing vegetables and fruits from environments, cooking thoroughly, use of safe water and raw materials and promotion of general awareness about food safety and food standards.

LIMITATIONS OF OUR STUDY

We have limitations in our study that only ELISA has been performed and further studies towards detection of molecular and genetic characterization has not been done. We did not detect for the presence of other diarrheal pathogens which includes bacterial,

parasitological and viral infections and those caused due to chemical intoxications.

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