Overview of the 1990 viral gastro-enteritis outbreak from oysters

Épidémie virale de 1990 due aux huîtres

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Abstract

In 1990 there were 57 separate outbreaks of viral gastro-enteritis over 18 days implicating raw oysters from a large oyster producing area. Of 1,750 people involved in 11 outbreaks, 550 ate oysters and of these 446 (81%) were ill (mean incubation period 36 hours) with symptoms persisting for several days. Norwalk virus was detected in patients' stools and there was serological evidence of Norwalk viral infection in blood specimens. Remaining opened oysters (11 samples) from implicated batches were examined for standard plate count, faecal coliforms and *Escherichia coli* with only 1 sample complying with micro biological standards. *Vibrio vulnificus* and *Vibrio parahaemolyticus* were detected at low levels while Salmonella, *Campylobacter jejuni*, and *Staphylococcus aureus* were not. Norwalk virus not able to be isolated using electron microscopy.

Some oysters could not be traced back to their source due to inadequate records and mixing of oysters from different estuaries at processing level.

Large volumes of untreated sewage and stormwater run-off overflowed and polluted harvesting areas following heavy rainfall. *E. coli* (counts up to 60/g) was detected in oysters and harvesting and purification were voluntarily suspended, preventing any likelihood of food poisoning outbreaks.

Despite abatement of the sewage overflow, extending the suspension period by 3 days to allow a period of natural cleansing, testing harvesting areas, purifying oysters and attempting to monitor purified oysters for *E. coli* prior to sale, Norwalk virus persisted in oysters causing the outbreaks.

Besides improvements to the sewerage system, changes have been made to suspension periods, testing protocols and supervision by regulatory agencies. Using purification on its own as a pollution curative for oysters infected by Norwalk virus presents problems in New South Wales at least.

Keywords: Oysters, viral gastro-enteritis, Norwalk virus, *Escherichia coli*, purification, *Saccostrea commercialis*, food poisoning.

Résumé

En 1990, 57 épidémies distinctes de gastro-entérite virale se sont déclenchées en l'espace de 18 jours, mettant en cause des huîtres vivantes provenant d'une importante zone ostréicole. Sur les 1 750 personnes étudiées dans 11 de ces épidémies, 550 avaient mangé des huîtres et parmi celles-ci, 446 (81 %) étaient malades (période d'incubation moyenne 36 heures) et présentaient des symptômes persistant pendant plusieurs jours. Le virus de Norwalk fut détecté dans les fèces des patients et les examens sérologiques mirent en évidence la présence d'une infection par le virus Norwalk dans les échantillons sanguins. Une analyse par comptage sur plaque fut réalisée sur un reste d'huîtres ouvertes

(11 échantillons) provenant des lots incriminés, avec numération de coliformes fécaux et de *Escherichia coli*. Un seul de ces 11 échantillons s'avéra conforme aux normes microbiologiques. Les analyses permirent également de détecter une faible contamination de *Vibrio vulnificus* et *Vibrio parahaemolyticus* mais ne détectèrent aucune présence de salmonelles, de *Campylobacter jejuni* ni de *Staphylococcus aureus*. La microscopie électronique n'a pas permis d'isoler le virus de Norwalk.

Il ne fut pas possible de repérer l'origine de toutes les huîtres en raison d'une documentation incomplète et d'un mélange d'huîtres provenant de différents estuaires.

Des volumes importants d'eaux usées brutes et d'eaux de ruissellement avaient débordé et pollué les zones ostréicoles suite à de fortes précipitations. Après une détection de *E. coli* (jusqu'à 60/g) dans des huîtres, la récolte et la purification avaient été interrompues volontairement, pour éviter toute éventualité d'intoxication alimentaire.

Malgré l'arrêt des débordements d'égouts, une prolongation de 3 jours de la période de suspension pour permettre une épuration naturelle, le contrôle des zones d'élevage, la purification des huîtres et les tentatives de contrôle de *E. coli* dans les huîtres purifiées avant leur mise sur le marché, le virus de Norwalk a persisté dans les huîtres entraînant les épisodes de gastro-entérite.

Outre des améliorations apportées au système de tout-à-l'égout, les périodes de suspension de la commercialisation, les protocoles d'essai et le suivi par les agences de réglementation ont également été modifiés. L'utilisation de la purification seule pour remédier à la pollution d'huîtres infectées par le virus de Norwalk présente des problèmes, du moins en Nouvelle-Galles du Sud.

Mots-clés : Huîtres, gastro-entérite virale, virus de Norwalk, *Escherichia coli*, purification, *Saccostrea commercialis*, intoxication alimentaire.

INTRODUCTION

In 1990 there was a large outbreak of viral gastro-enteritis from Norwalk virus implicating raw oysters from Georges River, a very large oyster producing area in New South Wales (NSW), Australia.

Wide media coverage including the following newspaper headlines at the time had a devastating effect on the oyster industry. e. g.

Disease threat in wake of sewage flood
220 Poisoned by bad oysters
Ban on oysters as sicklist nears 600
Minister outlaws suspect oysters

This paper provides an overview of that outbreak.

Norwalk virus

Norwalk gastro-enteritis (also known as winter vomiting disease), has an incubation period of 24-48 hours producing a mild to moderate illness which is self-limiting. Clinical symptoms include nausea, vomiting, diarrhoea, abdominal pain, myalgia, headache, malaise and low grade fever lasting 24-48 hours. Man is the only known reservoir. Mode of transmission is via the faecal-oral route. The virus occurs world wide and has been implicated in outbreaks of gastro-enteritis implicating shellfish in USA and Australia (Otwell *et al.*, 1991). A study in the USA revealed that antibodies to Norwalk agent were acquired slowly and after 50 years, more than 60% of the population had antibodies (*Control of communicable diseases in man, 1990*). An endemic level is also considered to be present in New South Wales.

The virus cannot be cultivated in cell cultures and its identification is based on detection of viral antigens or viral particles in stools and rises in serum antibodies. Its detection in shellfish is particularly difficult.

Food-borne viral gastro-enteritis outbreaks associated with raw oysters in Georges River occurred previously in 1978 with Norwalk virus being the aetiological agent and municipal sewage overflows the viral source (Murphy *et al.*, 1979). There were reports of similar, smaller outbreaks in 1988 and 1989 (Kraa, 1990). The outbreaks occurred during peak oyster production and in the colder months when oysters were less likely to filter effectively.

Case histories

In April and May 1990 in Sydney, Australia, there were 57 separate outbreaks of viral gastro-enteritis over 18 days. The bulk of the data relates to 1 750 people involved in 11 of these outbreaks.

Of 895 people interviewed, 550 ate oysters and of these 446 (81%) reported illness with 143 (26%) consulting a doctor.

Mean incubation period was 36 hours (figure 1) and symptoms in order of incidence were diarrhoea, nausea, abdominal cramps and vomiting which persisted for several days. There were no deaths.

The small 27-32 nm Norwalk virus was identified by immune electron microscopy (IEM) in 6 (26%) stool specimens.

Acute and convalescent sera were obtained from 27 victims involved in 5 of the outbreaks. Increases (> fourfold) in radio immunoassay (RIM) titres were considered significant sero-responses for Norwalk virus in 20 (74%) cases.

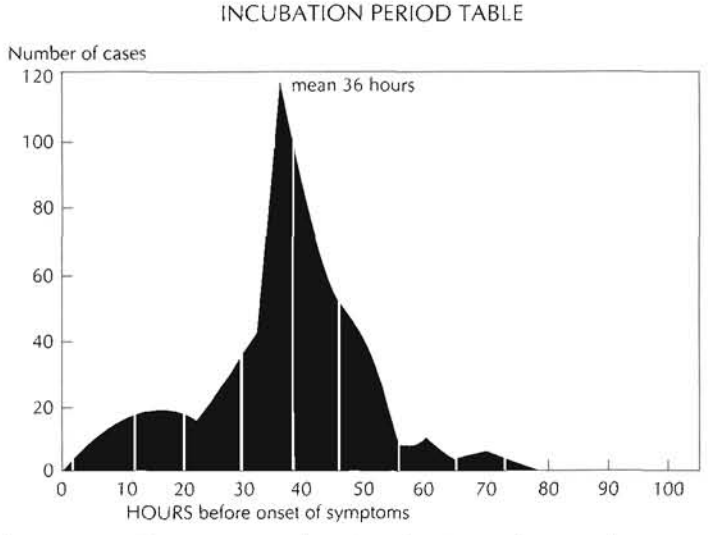

Figure 1 : Epidemic curve showing the time of onset of symptoms (incubation period)

Attack rates were 80% (mean) for those who ate oysters (range 41-100%) and 12% (mean) for those who did not eat oysters (range 0-62%), with the difference being 66% (mean). Attack rates for those who consumed specific foods and those who did not, confirmed raw Sydney rock oysters (*Saccostrea commercialis)* as the suspect menu item. In some cases the same batch of oysters was implicated in different outbreaks.

Oyster quality

Remaining opened oysters (11 samples) from 8 outbreaks were examined microbiologically for standard plate count, *Escherichia coli* and faecal coliforms (S.A.A., 1976a). Standard plate counts were 350-1,100,000/g with 3 (40%) exceeding 100,000/g. Faecal coliform counts were < 0.4-460/g with 9 (90%) exceeding 2.3/g. *E. coli* counts were < 0.2-4.3/g with 5 (50%) and 2 (20%) exceeding 0.5/g and 2.3/g respectively.

In New South Wales, maximum levels are 500,000/g for standard plate count and 2.3/g for faecal coliforms (NSW Food Act, 1989). Maximum *E.coli* count is 0.5/g (National Health & Medical Research Council, 1987). Only 1 sample was micro biologically satisfactory.

Salmonella, *Campylobacter jejuni* and *Staphylococcus aureus* were not detected however, *Vibrio vulnificus* and *Vibrio parahaemolyticus* were present at low levels in 3 (30%) samples from the one outbreak. Norwalk virus was not able to be isolated from oyster samples using electron microscopy.

Inspections of oyster opening and catering establishments failed to reveal any practices which could have significantly influenced bacterial levels in the oysters.

Oyster source

The oysters were harvested from 4 different estuaries approximately 450 km apart, treated in 12 different purification plants and opened by 15 different processors.

Nearly all incriminated oysters were traced to Georges River. (Oysters incriminated in 17% of outbreaks could not be traced further back than processing level due to inadequate records at that level and the traditional practice of mixing oysters from different estuaries during processing).

Approximately 12.3 million oysters (1989/90) are produced from 26 purification plants (382,000 oysters per batch total capacity) on Georges River annually, making it one of the largest producing areas in Australia.

Monitoring procedures

Standard procedures provide for a suspension of harvesting and purification when the harvest areas are affected by pollution, turbidity or an inflow of fresh water which may be due to flooding, rainfall, sewage or storm water overflows. Salinity measurements of harvest areas, subjective assessments of turbidity, inspection of live oysters, patrols of suspect sewage and storm water overflow points and notification procedures of such overflows are used routinely to monitor the quality of harvest areas.

Following earlier viral gastro-enteritis outbreaks, a special quality control plan was implemented for Georges River oysters which included bacterial monitoring of harvest areas and oysters before and after purification. Suspect sewage and storm water overflow points during heavy rainfall were also monitored.

During dry periods physical and microbiological qualities of oysters and their harvesting waters were satisfactory, but in April following heavy rainfall (309 mm in 21 days), a substantial volume of untreated sewage overflowed directly into at least one large harvesting area.

The subsequent reduction in salinities throughout the harvesting areas resulted in immediate voluntary harvesting suspensions which prevented oysters being marketed and there were no reports of food poisoning. Bacterial monitoring under the local oyster quality control plan confirmed that *E. coli* was present in oysters and that counts were increasing up to 60/g (S.A.A., 1976b). Water quality and *E. coli* counts continued to be monitored daily during the suspension.

Following abatement of the sewage and stormwater overflows into Georges River and a return to normal salinities and turbidity, the suspension was extended a further 3 days to allow a period of natural cleansing. Each batch of purified oysters was supposed to be tested for *E. coli* (S.A.A. 1976b) and only those batches in which *E. coli* was not detected (< 0.5/g) were to be released for sale. This procedure prevented the sale of many batches however, those testing satisfactorily together with others which were sold without testing, were incriminated in the outbreaks which followed. *E. coli* counts for rejected batches varied widely (range 1.5-60/g). This may account for the wide variation in the micro biological quality of oysters incriminated in the outbreaks. The NSW Health Department increased its level of bacterial monitoring at oyster processing establishments during and after heavy rainfall and found *E. coli* counts (S.A.A. 1976a) in oysters at that time also varied widely (range < 0.3-93/g). Purification plants were found to be generally satisfactory with some having a high level of operational standard.

Monitoring harvesting waters for salinity, turbidity and pollution together with testing oysters for *E. coli* indicated when harvesting and purification should be suspended. Despite extending normal harvesting suspension periods to allow a period of natural cleansing, bacterial testing of harvesting waters, purifying oysters and monitoring purified oysters for *E. coli* prior to sale, Norwalk virus persisted in oysters causing food poisoning outbreaks.

Additional controls

The sewerage system has been modified at large expense to prevent a recurrence of overflows into the largest harvesting area during heavy rainfall, regulatory agencies have increased their monitoring role and the local oyster quality control plan (based on industry self-regulation and funding) has been substantially modified.

i.e. Suspension periods have been increased to a minimum of 5 days following the harvesting waters returning to normal, environmental monitoring has been increased and immediately following a suspension, each batch of oysters (pre and post purification) is closely monitored for *E. coli*.

CONCLUSION

For Georges River, purification was intended to provide an additional barrier to the transmission of disease from oysters to man, enhancing environmental monitoring of growing areas.

The use of purification as a pollution curative for oysters infected by Norwalk virus presents problems in New South Wales at least. Whilst oyster harvesting areas can be affected by viral pathogens a threat to public health continues to exist through the consumption of raw oysters. Development of an economical, rapid method for the detection of viruses in oysters is considered essential to the long term quality assurance of oysters grown in areas likely to be affected by even accidental sewage pollution. Adequate supervision of harvesting suspensions by regulatory agencies and co-ordinated industry self-regulation may provide additional controls.

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