

Case Study - Presence of *Salmonella* Species in Coconut after Kerala Flood2018

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ABSTRACT

A case study that accidentally found *Salmonella* species, a very rarest case, from flood affected *Cocosnucifera* while processed in frozen food industry. Coconut is actually considered to be safe and contamination free because of its hard-outer covering, amidst the presence of highly nutritive water content. This was proved to be wrong after the identification of different species of bacteria from coconuts collected during the flood period and was identified during the routine tests.

KEYWORDS: Coconut, flood, *Salmonella* species, XLD agar, biochemical tests.

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I. INTRODUCTION

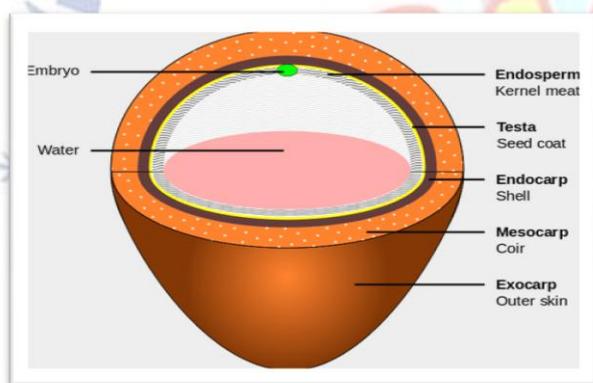
Foodborne diseases encompass a wide spectrum of illnesses and are a growing public health problem worldwide. They are the result of ingestion of foodstuffs contaminated with microorganisms or chemicals. The contamination of food may occur at any stage in the process from food production to consumption ("farm to fork") and can result from environmental contamination, including pollution of water, soil or air.

The most common clinical presentation takes the form of gastrointestinal symptoms; and can also have neurological, gynecological, immunological problems. Multiorgan failure and even cancer may result from the ingestion of contaminated foodstuffs, thus representing a considerable burden of disability as well as mortality. *Salmonella* is one of the major foodborne pathogens in worldwide. *Salmonella* are a group of

bacteria that can cause gastrointestinal illness referred to Salmonellosis. CDC estimates *Salmonella* causes about 1.2 million illnesses, 23,000 hospitalizations, and 450 deaths in the United States every year. Food is the source of about 1 million cases of these illnesses. Most people infected with *Salmonella* develop diarrhea, fever, and abdominal cramps (SALMONELLOSIS) 6 hours to 4 days after infection. The illness usually lasts 4 to 7 days, and most people recover without treatment.

In some people, the illness may be so severe that the patient needs to be hospitalized. *Cocosnucifera* or coconuts a common drupe seen in Kerala. Coconut (*Cocosnucifera*) is packed with high nutrients, macro nutrients, vitamins etc. and so they are very much prone to contamination. Coconut has protective layers of exocarp, mesocarp making up the husk and the seed is protected by a

stony shell endocarp and it is aseptic. Frozen shredded coconut is one of the major exporting products of coconut. There are many frozen food industries which are making great profits out of this. But after the Kerala flood of 2018, coconut collected from Palakkad and Ernakulam where highly contaminated with *Salmonella* and other organisms, thought to be the result of the contaminated flood water. *Salmonella*, Enteric bacteria and Coliforms have been isolated during the routine microbial analysis using Rappaport Vassiliadis Medium and Xylose Lysine Deoxycholate agar, which was further confirmed by biochemical analysis. This is one of the first studies which showed up the contamination by *Salmonella* and other organisms on "*Cocos nucifera*" (Schaffner et., al, (1)) through the penetration of contaminated water through the husk and shell. This study highly emphasis on the potential risk of obtaining Salmonellosis from the unprocessed raw coconut used as the raw material in food industry during 2018 Kerala flood (2)



Structure of Coconut

II. KERALA FLOOD 2018

On 16 August 2018, severe flood affected the south Indian state Kerala, due to the unusual high rainfall during the monsoon season. Chengannur, Pandanad, Edanad, Aranmula, Kozhencherry, Ayiroor, Ranni, Pandalam, Kuttanad, Malappuram, Aluva, Chalakudy, Thrissur, Thiruvalla, Eraviperoor, Vallamkulam, Chellanam, Vypin island and Palakkad these are the majorly affected areas .

The worst effect of flood is the accumulation of drainage water, sewage water, septic tank water, hospital waste etc through which diseases can spread quickly.

III. PROCESSING OF COCONUT

In frozen industry "frozen grated / shredded coconut" is the demand product for exporting to

foreign countries. The coconut from all over Kerala was collected for processing, mainly from Palakkad and Ernakulam. After flood about around 5 metric ton of coconut as raw material was collected from a seller and he procured the coconuts from Ernakulam and Palakkad. From primary quality check of raw material inspection, it was found that the outer shell had a huge amount of moisture content and the sample was then collected from the processing room and the routine test was done, which showed that it was high in contamination. Variations in TPC was also found. The sample also showed the presence of *Salmonella species*, Enteric bacteria etc. Another sample was taken on the next day by selecting and screening the raw materials and run the test it again showed the same results. Even after the increase in the chlorination concentration, the results didn't change. On the third and final day of production the results were even worst, indicating the multiplication of *Salmonella*. The coconuts were then discarded without processing. After the enquiry with the details from the seller it was found that those coconuts were from the flood affected areas.

This was one of the rarest cases even after we consider the presence of husk which is able to protect the entire coconut, the contaminants breach through the protective layers and caused contamination.

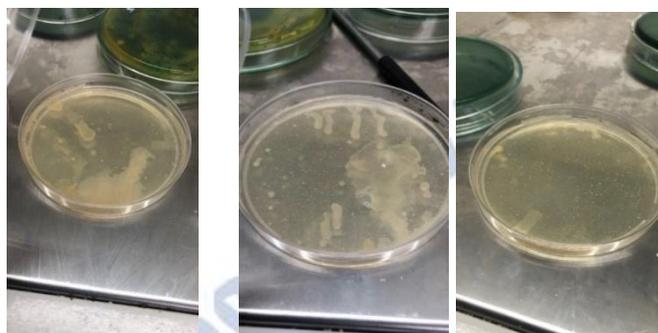
Another sample was taken on the next day by selecting and screening the raw materials and run the test, the same results were found even after the chlorination concentration was increased.



Contaminated Coconut from the outside

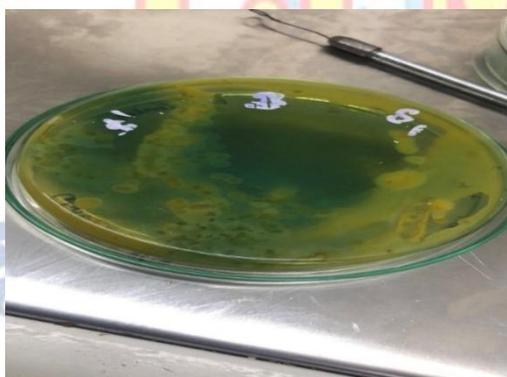
Further microbiological procedures were carried out to confirm and the following results were obtained.

1. All the 3 dilutions 10^{-1} to 10^{-3} were found to be **TNTC** (too numerous to count), this indicates that the food cannot be consumed directly and it is highly contaminated.



10^{-1} 10^{-2} 10^{-3}
Colonies present in nutrient agar

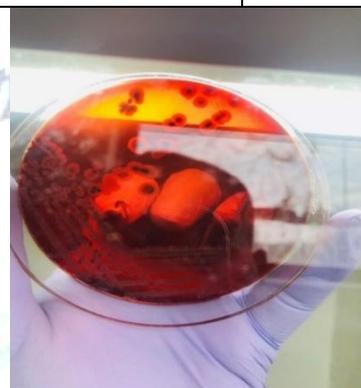
2. MacConkey agar for the detection of enteric bacteria (Edwards and Ewing (3)). Enteric bacteria were present in the sample of coconut. Enteric bacteria are present usually in the intestines.



Colonies in MacConkey Agar

3. Salmonella identification can be grown using XLD agar (xylose lysine deoxycholate agar) (WHO, (4)). Salmonella was identified by colony morphology, black centred colonies are the *Salmonella sps* on XLD agar (Zajc-Satler and Gragas, (5)).

Biochemical test	Results
On TSI slant	R/Y/H ₂ S+/g+
Lysine decarboxylase	positive
Citrate utilization	positive
Urease	negative
Motility	positive
Indole	negative
MR	positive
VP	negative



Colonies of Salmonella on XLD agar

4. Biochemical tests for the confirmation of *Salmonella species*

Presumptive positive colonies were characterized using secondary biochemical tests for the confirmation of the organism. Thus, the organism was confirmed to be *Salmonella sps.* (WHO(6)).

The naturally aseptic *Cocos nucifera* gets contaminated easily through a flood. It was due to the presence of bacteria and other organisms in the flood that came through by various ways (like sewage waste, septic tanks, hospital wastes etc).

The husk of the coconut absorbed the contaminated flood water and that water causes the germination spores to decay and finally it enters into the coconut causing contamination. It was found that a single coconut can spoil the entire production with its contamination. Hence proper checking of the coconut is necessary before starting the processing.

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