

Paper presented at the National Symposium on Sustainable Development of Fisheries Towards 2020 AD, held at School of Industrial Fisheries, Cochin University of Science and Technology, Cochin, 21- 23, 1999.

## **Distribution of *Clostridium botulinum* in finfish and shellfish from Indian waters**

K.V.Lalitha and P.K.Surendran  
Central Institute of Fisheries Technology  
Cochin-682 029, India

### **Abstract**

*Clostridium botulinum*, a gram positive spore forming bacterium, is the causative agent of highly lethal food poisoning namely 'botulism' in man. Strains of *C. botulinum* are classified into seven serotypes (A to G) depending on the serological specificity of the neurotoxin produced. The organism is found naturally in numerous terrestrial and aquatic habitats. The distribution of *Clostridium botulinum* serotypes in finfish and shellfish collected from onboard fishing vessel and from the retail markets in and around Cochin were examined. A total of 167 samples of finfish and shellfish were tested. An overall prevalence of 16% was found. In freshly caught fish, of the 90 samples tested, 12% harboured *C. botulinum*. In finfish/shellfish obtained from the retail markets, the overall contamination level was 21% (16/77), it ranged from 16% for marine finfish to 22% for brackishwater finfish, to 30% for shrimp and to 33% for freshwater prawn. Incidence of *C. botulinum* was high in prawn. Most of the samples harboured type D spores followed by type C, type B and type A. Type E was noticeably absent from the samples tested.

## Introduction

*Clostridium botulinum* is the causative agent of a fatal form of food poisoning namely "botulism" in man. It is a gram positive anaerobic spore forming bacterium, the strains of which are classified into seven types A to G depending on the serological specificity of the neurotoxin products. The organism is found naturally in numerous terrestrial and aquatic habitat (Hauschild 1989; 1993). Many of the botulism outbreaks recorded in Canada, USA, USSR, Europe, Japan and Iran were traced to the consumption of uncooked, undercooked, smoked, state or fermented fish and also to seal or whale meat (Sakaguchi 1979; Hauschild 1993). The recorded cases of human botulism are mainly due to *C. botulinum* type A, B and E and few type F botulism have been reported. It is still debated as to whether *C. botulinum* type C and D can cause human botulism. In recent years, strains of species other than *C. botulinum* (viz. *C. barati* and *C. butyrium*) have been found which produced type F and type E infant botulism cases respectively (Hatheway 1993).

*Clostridium botulinum* has been isolated from wild and farmed fish (Hauschild 1993; Lalitha and Iyer 1990; Lalitha and Surendran 1992; Lalitha and Surendran 1993; Lalitha and Gopakumar 1995). In most foods, *Clostridium botulinum* is controlled by inhibition rather than destruction. Psychrotrophic strains of *C. botulinum* (*C. botulinum* type E and nonproteolytic type B and F) are able to grow and produce toxin in fish at refrigerated temperatures. In this study, the main aim was to gain information on contamination levels of *C. botulinum* and type distribution in freshly caught and retail finfish/shellfish in order to assess the risks associated with consumption and industrial processing of finfish and shellfish.

## Materials and Methods

167 samples of finfish and shellfish obtained from on board fishing vessel FORV Sagarsampada and from the retail markets in and around Cochin were examined for the presence of *C. botulinum* using a procedure as described by Lalitha and Surendran (1992). The toxicity test and toxin neutralisation tests were carried out in mice and isolation of *C. botulinum* were done as per methods followed by Lalitha and Surendran (1992). The

*botulinum* type E is the predominant spore type found in aquatic environments and fish and fishery products reported in worldwide studies of temperate geographical areas (Dodds 1993; Hauschild 1993; Hielm et al 1998).

*Clostridium botulinum* types A, B, C and D were isolated from the positive samples. Types A and B cultures isolated were proteolytic whereas type C cultures were nonproteolytic and type D cultures isolated were mildly proteolytic. Many of the types C and D cultures isolated had lost their toxigenic properties during transfer in laboratory media.

*Clostridium botulinum* serotypes prevalent in finfish/shellfish from Indian waters are type A, B, C and D. Fresh fish have never been implicated in human botulism (Huss 1994). Therefore the mere presence of *C. botulinum* serotypes in fresh fish will not cause illness, conditions must be such that viable *C. botulinum* spores are present and are given the opportunity to germinate and produce toxin. Proteolytic strains of *C. botulinum* types A and B are not able to grow at refrigerated temperature ( below 10°C). Therefore if the fish are properly handled and processed the food is safe and fit for human consumption. The recorded cases of human botulism are mainly due to types A, B and E. Psychrotrophic strains of *C. botulinum* are noticeably absent in finfish and shellfish. Prevalence of type *C. botulinum* types A and B in finfish and shellfish indicates the chances of potential food poisoning particularly when resort to the modern methods of fish packaging like the vacuum/ modified atmosphere packaging with out proper refrigeration. Fresh fish should be properly handled and adequately processed to maintain the bacteriological safety.

Table 1: Distribution of *Clostridium botulinum* types in finfish and shellfish

Species	Source of sample	No. of samples tested	No. of samples positive for <i>C. botulinum</i>	<i>C. botulinum</i> types identified
<u>Marine species</u>				
Fin fish	Onboard vessel	80	11	5D, 3C 2B, 1A
Cuttle fish and squid	Onboard vessel	6	-	-
Deepsea prawn and lobster	Onboard vessel	4	-	-
Fin fish	Cochin retail market	37	6	4D, 2C
Shrimp	Cochin retail market	20	6	6D
Mussel	Cochin retail market	3	-	-
<u>Brackishwater species</u>				
Fin fish	Cochin retail market	9	2	1A, 1D
<u>Freshwater species</u>				
Finfish	Cochin retail market	2	-	-
Prawn	Cochin retail market	6	2	1C, 1D.