

Prevalence of *Clostridium botulinum* in Semipreserved Meat Products

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Samples of semipreserved meat products were taken, and 372 were examined for *Clostridium botulinum*. Five samples contained type A and one sample type B.

The rarity of botulism caused by semipreserved meat products is believed to be due partially to a low prevalence of *Clostridium botulinum*. However, there are very few reports in direct support of this. Greenberg et al. (1) found *C. botulinum* (type C) in only one of more than 2,000 meat samples taken very shortly after slaughter. Tac-

ferric citrate, and 3 g of agar dissolved in 1 liter of distilled water, pH adjusted to 7.2. A 100-ml amount of the solution was filled into a 6-oz (ca. 180 ml) cylindrical tin can (type used for food canning). Approximately 30 g of ground beef was added to the tin can which was then autoclaved for 15 min at 121 C with a loose lid on. After cool-

TABLE 1. Examination of 372 samples of semipreserved meats for *Clostridium botulinum*

Product	pH	Glucose (%)	Brine (%) ^a	No. of samples examined	No. of samples with botulinum toxin	No. of isolates of <i>C. botulinum</i>	Type of <i>C. botulinum</i>
Bologna	6.0-6.9	2.0	2.3-2.5	36	0	0	
Cooked ham	5.1-6.5	0-0.1	1.5-3.6	100	5	2	A
Smoked turkey	5.7-6.5	0-0.1	2.3-3.0	41	1	1	B
Smoked chicken	5.8-6.4	0-0.1	2.0-3.0	50	0	0	
Corned beef	6.0-6.3		2.3-3.4	20	0	0	
Smoked beef	6.1-6.2		3.3-3.6	30	0	0	
Liver sausage	6.3-6.4	2.0	2.4-2.7	14	0	0	
Luncheon loaf	5.5-6.1	0.25-0.5	1.6-3.0	33	0	0	
All beef salami	6.1-6.2		2.5-3.3	20	0	0	
Smoked pastrami	5.8-6.0	0.1	2.8-3.0	10	0	0	
Pork sausage	5.5-6.1	0.1-2.0	1.0-2.0	8	0	0	
Beef franks	6.2-6.3	0.1	2.1-2.3	4	0	0	
Smoked beef loaf	5.6-6.1	0.1	3.0-3.8	5	0	0	
Ham salad spread	4.6	0.1	2.5	1	0	0	

^a Brine concentration expresses the concentration of salt in the water phase in the foods and is equal to $\%NaCl / (\%NaCl + \%H_2O) \times 100$.

lindo et al. (4) found type B in 1 of 73 samples of semipreserved meat products and Insalata et al. (2) found type B in a sample of frankfurters among 400 samples of delicatessen-type foods. The apparent discrepancy in prevalence in these three surveys may be explained by differences in sample size, media, and microbial competition.

We conducted a survey by using the following enrichment medium: 2 g of Na_2HPO_4 , 0.3 g of

into 70 or 75 C, 0.5 ml of a sterile filtered 10% solution of cysteine hydrochloride was added. The medium was then inoculated with 30 g of semipreserved meat, covered with sterilized commercial lard, and incubated at 30 C, the lid being loose. After 4 to 5 days, a sample of this enrichment culture was withdrawn with a pipette. If blackening was apparent, indicating the presence of H_2S and growth of clostridia (3), the sample was frozen for 24 hr to break up the agar gel and the supernatant was injected into mice for toxin

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detection. After botulinum toxin was detected and typed with specific antitoxins, isolation of the organism from the enrichment culture was attempted by streaking on Tryptose-blood-agar and egg yolk-agar (5) followed by identification of toxin formed in Brain Heart Infusion broth.

Preliminary trials showed that 10 or fewer spores of *C. botulinum* type A, C, and E inoculated into 30 g of different types of semipreserved meat could be detected. During 1 year, 372 samples of semipreserved meat products were taken at the time of delivery to two local supermarkets and examined. The results are presented in Table 1. The compositions of the samples containing *C. botulinum* would permit multiplication at the proper temperature.

The prevalence of *C. botulinum* found in this study is in fair agreement with the data reported by Taclindo et al. (4) and Insalata et al. (2) but apparently much higher than reported for fresh meat (1). However, this difference may not be real. Greenberg et al. (1) used a small inoculum from a large number of samples. Thus, the total amount of meat actually inoculated in their study was 16

lb (ca. 7.3 kg) as compared to 8 lb (ca. 3.6 kg) in the studies by Taclindo et al. (4) and 25 lb (ca. 11.3 kg) in our study. The evidence from the studies suggests that the overall *C. botulinum* prevalence in meat and meat products is low.

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