PSYCHROTROPHIC PATHOGENS ASSOCIATED WITH MEAT AND FISH

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Food microbiologists have traditionally relied on refrigeration (holding of food at 5°C) to restrict the growth of foodborne pathogens. This reliance is based on the observation that the so-called big three pathogens, *Salmonella, Staphylococcus aureus,* and *Clostridium botulinum* types A and B, are not capable of growth at 5°C. However, over the last 25 years, the list of foodborne pathogens has expanded to include *Campylobacter jejuni, Yersinia enterocolitica, Listeria monocytogenes, Aeromonas hydrophila, Shigella, Plesiomonas shigelloides,* enteropathogenic *Escherichia coli, C. botulinum* type E, *Vibrio parahaemolyticus, Bacillus cereus,* and *C. perfringens.* One characteristic of certain of these pathogens has caused considerable concern to food microbiologists: their ability to grow at 5°C. Psychrotrophic growth has been observed in *Y. enterocolitica, L. monocytogenes, C. botulinum* type E, toxigenic *E. coli,* and *A. hydrophila.*

The sources of these emerging psychrotrophic pathogens is varied, though they are often directly associated with foods of animal origin and the water supply. *Y. enterocolitica* and *A. hydrophila* are found in many water supplies and this undoubtedly represents the way they enter the food. *C. botulinum* type E is found in marine environments, in contrast to type A and B strains which are predominantly of soil origin. As with all strains of *E. coli,* toxigenic *E. coli* are found in the lower part of the intestine of warm blooded animals. *L. monocytogenes* is found primarily in the soil, vegetation, sewage, and water.

The food poisoning syndrome caused by these emerging psychrotrophic pathogens is varied. *Y. enterocolitica, A. hydrophila,* and toxigenic *E. coli* are associated with gastro-intestinal symptoms. *C. botulinum* type E produces a neurotoxin. Finally, *L. moncytogenes* causes a wide spectrum of symptoms ranging from mild flu-like disorders to meningo-encephalitis, septicemia in the perinatal period, pneumonia, endocarditis, and abortion. In addition, *A. hydrophila* can cause various extra-intestinal problems ranging from wound, eye, and throat infections to sepsis, meningitis, and pneumonia.

Though it is often recommended that foods be held at 5°C, surveys have indicated that temperature abuse occurs throughout the food-handling chain and for all product types. Torrey and Marth found that the air temperature of home refrigerators could be as high as 20°C. Bryan et al. observed that airline catering operations often maintain food at temperatures above 7.2°C. Meat and dairy products in display cases are often found at temperatures above 7.2°C. Rose, in a recent survey of salads in

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the UK, found that more than half of the samples were above 5°C, and some were as high as 20°C.

Foods held in the temperature abuse range—5°C to 12°C—often can become hazardous from several pathogens which can grow in this temperature range. *V. parahaemolyticus* grew in oysters held at 8°C; *B. cereus* grew in broth at 7°C; *S. aureus* grew in custard held at 7.7°C and lab-cured ham at 10°C; *Salmonella* grew in chicken a la king held at 6.7°C, in broth held at 5.2°C in 19 days, and ground pork with 2% NaCl held at 10°C.

In addition to growth at 10°C, heat injured *S. aureus* can repair at this temperature. This is of importance since recent work from this laboratory has indicated that injured cells, once they have repaired, are capable of producing entertoxin.

The presence of enterococci *(Streptococcus faecalis* and *S. faecium)* in foods is often used as an indicator of fecal contamination. However, these two organisms also can grow at 10°C. Thus, the growth of an indicator organism under conditions of moderate temperature abuse could invalidate its use as an indicator.

A recent article by Miller and Koburger has reviewed *P. shigelloides* and its potential as a food poisoning organism. While this waterborne organism is not psychrotrophic, it is capable of growth in the range of 10°C. Though the extent of its occurrence in foods is not presently known, temperature abuse conditions would permit the growth of this organism.

In addition to preserving foods, low temperature can also preserve the viability of bacteria. Several studies on *C. jejuni* (minimum temperature of growth, 30°C) have indicated that the organism retains greater viability in foods when the food is held at around 5°C. Brucella has also been observed to survive long periods in foods such as cheese held at 4°C.

In the '50s and '60s, refrigeration of foods was found not to be adequate to prevent the growth of spoilage organisms; currently, with the emergence of these new psychrotrophic pathogens, refrigeration can't be considered adequate to prevent the generation of a foodborne hazard from these pathogens. Since these organisms occur widely in nature, and especially in the water supply and subsequently in foods of animal origin, their presence in foods cannot be prevented, and means other than refrigeration must be investigated to restrict their growth in foods.

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