

Lack of Staphylococcal Enterotoxin Production among Strains of *Staphylococcus aureus* from Bovine Mastitis in Denmark

Staphylococcal enterotoxins (SE's) are a group of small exoproteins produced by some strains of *Staphylococcus aureus*. The SE's, designated A to E according to their antigenic specificities, are important causes of food poisoning worldwide. Milk and dairy products are frequently associated with *S. aureus* enterotoxin food poisoning, and it is supposed that infected milk from mastitic animals constitute the main source of enterotoxigenic *S. aureus* of animal origin (Bryon 1983, Gilmour & Harvey 1990, Bergdoll 1989). Indeed, *S. aureus* is the most common cause of bovine mastitis worldwide, and if mastitis strains produce SE this makes up an enormous reservoir of potential enterotoxin producers. The production of SE by *S. aureus* isolated from bovine mastitis have been investigated in several countries (Matsunaga *et al.* 1993, Kenny *et al.* 1993, Olson *et al.* 1970, Orden *et al.* 1992, Olsvik *et al.* 1981, Adekeye 1980, Garcia *et al.* 1980, Abbar 1986, Harvey & Gilmour 1985). Since no studies have been performed on the prevalence of enterotoxigenic strains of *S. aureus* isolated from bovine mastitis in Denmark, a well characterized collection of *S. aureus* (Aarestrup *et al.* 1995) was investigated with respect to this property.

One hundred and six isolates of *S. aureus* from clinical and subclinical cases of bovine mastitis from 106 Danish dairy farms were investigated. The strains belonged to a large

number of different geno- and phenotypes. All strains were tested for production of SEA to SED by reverse passive latex agglutination with a commercial available kit (Oxoid, Wesel, Germany). As positive controls were included 3 SE-producing strains, ROS121 producing SEB and SED, FRED7 producing SEC and HORS2817 producing SEA. No attempt was made to test specifically for SEE, but as SEE is reported to cross-react with SEA, it should give positive results with SEA antisera (Lee *et al.* 1978).

None of the 106 *S. aureus* strains from bovine mastitis produced SE, whereas the 3 positive controls gave positive reactions indicating appropriate test conditions and Kit-performance.

In order to estimate the true prevalence of a property among strains of a particular origin, it is important that the sample collected is representative for and randomly selected among the population studied. In this study strains isolated from different cases of bovine mastitis from different farms in Denmark and belonging to several different geno- and phenotypes were tested for their production of SE. None of the 106 strains studied produced SEA-D, and even though the collection is small this strongly indicates that this property is uncommon among strains of *S. aureus* isolated from bovine mastitis in Denmark. Furthermore, the results implies that production

of SE is not associated with virulence for strains of *S. aureus* causing bovine mastitis. Other investigators have reported significantly higher prevalences of SE producing strains. Examination of 46 isolates for production of SEA-C in Norway in 1981 revealed that 32 (69%) produced SE (Olsvik et al. 1981). However, there is no indication of whether all of these strains were from mastitic milk. In North America, Olson et al. (1970) examined strains from acute mastitis and Kenny et al. (1993) examined strains from mammary secretions and found 19% and 27% strains positive for production of SEA-D and A-E among 157 and 262 strains respectively. Matsunaga et al. (1993) found 34% positive among 58 mastitis strains investigated for production of SEA-D in Japan. In studies of 50 strains of bovine origin for production of SEA-C and SEE from Nigeria, Adekeye (1980) found 12% positive, but it is not stated whether these strains are from milk. In studies of mastitis strains in Spain, Orden et al. (1992), Garcia et al. (1980) and Abbar et al. (1986) found 19% (A-E), 7% (A-D) and 13% (A-D) positive strains, respectively, among 26, 57 and 45 strains investigated. In closer agreement with the present study were the studies by Lopes et al. (1990) in Brazil and Harvey & Gilmour (1985) in Northern Ireland. In these latter studies, 127 and 56 mastitis strains were investigated for production of SEA-E, and 5% and 4% were positive, respectively. Thus, the percentage of SE producing strains of *S. aureus* from bovine mastitis have varied considerably among studies, which may be a reflection of differences in the extramammary reservoir in the various countries. SE production seems not to be associated with the capability of strains of *S. aureus* to cause bovine mastitis. The observations in this study indicate that mastitic milk does not constitute any large risk for *S. aureus* enterotoxin food poi-

soning in Denmark. Contamination of milk or dairy products with SE producing strains of *S. aureus* might more commonly arise from human or animal carriers, but care should be taken to avoid any kind of contamination.

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(Received January 12, 1995; accepted February 23, 1995).

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