UPDATE: PREVALENCE OF SALMONELLA IN PORK SAUSAGE

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Summary

One hundred seventy-five samples of fresh pork sausage representing thirty-five different commercial brands from six different retail stores were examined for the presence of salmonellae by standard enrichment, plating, biochemical and serological techniques. Contamination levels varied from 0 to 50% among stores and from 0 to 28% among brands. Prior research implied reduced prevalence of salmonellae in fresh pork sausage; however, these results indicate no variation in prevalence since 1969.

(Key Words: Meat, Microbiology, Pork Sausage.)

Introduction

Salmonella species were first isolated from pork in 1885 by Salmon and Smith. Since that time other investigators have isolated Salmonella from swine carcasses (Ruben et al., 1942; Galton et al., 1954; McDonagh and Smith, 1958; Newell et al., 1959; Weissman and Carpenter, 1969; Carpenter et al., 1973; Childers et al., 1973). Galton et al. (1954) and Shotts et al. (1961) determined that Salmonella species are a part of the normal gut microflora of swine; therefore, these organisms may spread through a herd via mud and manure inherent in livestock holding pens. Hanson (1964) found that holding swine in pens for prolonged periods tended to increase the incidence of Salmonella species within a herd.

Cherry et al. (1943) found fresh pork sausage from retail markets to have a 2% incidence of Salmonella. Weissman and Carpenter (1969) isolated salmonellae from 38% of the samples examined while Surkiewicz et al. (1972), in a later study, found that 29% of the samples tested were positive for Salmonella. Johnston et al. (1982) performed a survey and compared their findings with previous investigations to determine trends in the prevalence of Salmonella species in fresh pork sausage over the years of study. This study put the level of contamination at only 12% and concluded that a decrease in the prevalence of Salmonella in fresh pork sausage did exist. The presence of salmonellae even in small numbers was considered contamination due to the potential health hazard that may occur should the product be subjected to mishandling before use, i.e., time/temperature abuse.

The purpose of this study was to compare the incidence of Salmonella in fresh pork sausage found in 1983 with results of other studies. Test samples represented nationally distributed brands as well as brands produced in the Southeastern United States.

Methods and Materials

The basic method for the determination of the presence of salmonellae was that recommended by Galton et al. (1968). Forty grams from 200 g of each brand of sausage were examined. The five samples were collected over a period of 5 mo (one sample/mo). The samples were selectively enriched by incubating 40-g samples in 150 ml of Bacto-Brilliant Green Tetrathionate Broth (Difco) for 48 h at 43 C with 6 ml of 10% D-tergitol/100 ml of broth. The organisms from the resulting enriched cultures were then streaked onto Bacto-Brilliant Green Tetrathionate Broth (Difco) for 48 h at 43 C with 6 ml of 10% D-tergitol/100 ml of broth. The organisms from the resulting enriched cultures were then streaked onto Bacto-Bismuth Sulfite Agar (Difco) and Bacto-Brilliant Green Agar (Difco) and incubated at 43 C for 48 and 24 h, respectively. Isolated colonies resembling typical Salmonella colonies were then picked onto Bacto-Triple Sugar Iron Agar (Difco) slants and Bacto-Lysine Iron Agar Slants (Difco) and incubated at 37 C for 24 h. The final step involved serological screening of the cultured organisms that exhibited characteristic Salmonella biochemical reactions using a slide agglutination technique. Cultures that

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TABLE 1. PREVALENCE OF SALMONELLAE AMONG BRANDS EVALUATED

<table>
<thead>
<tr>
<th>Store</th>
<th>No. of samples</th>
<th>No. of brands</th>
<th>Prevalence of salmonellae, %</th>
<th>Price ($)/454 g</th>
<th>Serotype isolateda</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>30</td>
<td>6</td>
<td>0</td>
<td>.99–2.99</td>
<td>S. infantis, S. muenster</td>
</tr>
<tr>
<td>B</td>
<td>30</td>
<td>6</td>
<td>50</td>
<td>1.19–2.39</td>
<td>S. adelaide, S. typhimurium, S. thompson</td>
</tr>
<tr>
<td>C</td>
<td>35</td>
<td>7</td>
<td>43</td>
<td>1.19–2.09</td>
<td>S. infantis</td>
</tr>
<tr>
<td>D</td>
<td>20</td>
<td>4</td>
<td>25</td>
<td>1.25–1.59</td>
<td>S. enteritidis</td>
</tr>
<tr>
<td>E</td>
<td>15</td>
<td>3</td>
<td>33</td>
<td>.99–2.49</td>
<td>S. infantis</td>
</tr>
<tr>
<td>F</td>
<td>45</td>
<td>9</td>
<td>22</td>
<td>.99–2.49</td>
<td>S. infantis</td>
</tr>
<tr>
<td>Total</td>
<td>175</td>
<td>35</td>
<td>Avg 27</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

aSerotyping confirmed by CDC, Atlanta, and Georgia Dept. Human Res. Clinical Lab., Atlanta.

Results and Discussion

The prevalence of Salmonella isolated from fresh pork sausage was found to be 27% (table 1). Previous studies have shown a decline in the prevalence of the organism in fresh pork sausage during the period from 1969 to 1979 (Johnson et al., 1982). The earlier investigation by Cherry et al. (1943) put the level of Salmonella contamination at only 2%; however, with more recent developments in isolation methodology, contemporary research has shown this value to be far too low. Weissman and Carpenter (1969) found high levels of contamination, 38%. A later report by Surkiewicz et al. (1972) placed the level of contamination of fresh pork sausage at 28.6%. The study of Johnston et al. (1982) found that 12.4% of the samples tested were positive for Salmonella; however, all samples were frozen before isolation which could have affected the results due to freeze injury. Obviously the specific methodology used for the assay would affect the final result. Probably the relative incidence of Salmonella in fresh pork sausage does fluctuate from time-to-time; however, there is no real evidence to support the conclusion that there was any real decrease in prevalence.

There was no relationship between prevalence of salmonellae and the price of the sausage. That is to say, Salmonella was found in both inexpensive and higher priced brands of sausage. No correlation was found between prevalence of the Salmonella and the stores surveyed.

Six different serotypes of salmonellae were isolated: S. infantis, S. muenster, S. adelaide, S. typhimurium, S. thompson and S. enteritidis. For 1980, the CDC reported 15% of the Salmonella isolates from human food made from animal sources were S. infantis while 11% of them were S. typhimurium (CDC, 1982). The other serotypes were also isolated from human sources, but to a much lesser extent.

The U.S. Department of Agriculture Advisory Committee has recommendations for production and processing practices designed to help reduce the numbers of Salmonella in raw meats as well as poultry (Anonymous, 1978). Continued research on those practices could help establish a trend towards lower incidence of contamination by Salmonella.

Literature Cited


Galton, M. M., G. K. Morris and W. T. Martin. 1968. Salmonellae in foods and feces. Center for...


