A RESEARCH NOTE

Beef Casings and Finished Beef Sausages as a Source of Salmonella in Iraq

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ABSTRACT

Of 80 pasturma beef sausages, 28 (35%) contained Salmonella anatum, S. typhimurium or S. molade. Analysis of 70 fresh beef casings yielded 6 (8.6%) samples contaminated with S. anatum; none of the 60 commercial beef casings were found to be contaminated.

Salmonellosis continues to prevail as a foodborne disease in the world. Raw or improperly cooked meat products, are frequently implicated (5,10,4). The incidence of Salmonella varies widely between and within countries (12,13,17,18,21). Conflicting reports on the prevalence of this microorganism likely depends on the specimen examined, the food type, and the method of analysis. Data on the incidence of Salmonella in meat products, such as beef casings and the very popular pasturma beef sausages in Iraq are generally lacking one. Pasturma sausages are produced entirely by local butchers using different formulations and are delivered to the shops for retail sale. There are thus, numerous opportunities for cross-contamination during processing. This study describes the prevalence of Salmonella in fermented pasturma sausages and investigates the survival of Enterobacteriaceae during the drying of salted casings.

MATERIALS AND METHODS

The isolation and identification of Salmonella spp. was done using a standard procedure (3). In this study, 70 fresh beef casings from an abattoir in Mosul City, 60 commercially prepared casings (dry and ready-to-wet stages) and 80 samples of fermented pasturma beef sausages were purchased from different major retail outlets during January to April, 1987. The sausage product is prepared by chopping approximately 50-60% meat, with the addition of 30-40% fat, 1% spices, 0,5% garlic and 2% NaCl. The mixes were stuffed into fibrous beef casings and hung at room temperature until the moisture of the sausage dropped to nearly dried. A 50-g sample was aseptically cut from each product and blended with 450 ml of lactose broth in a sterile Waring Blender. The blended sample was transferred to a sterile container for pre-enrichment at 37°C for 20-24 h. Portions (10 ml) of pre-enrichment cultures were selectively enriched in 90 ml of tetrathionate brilliant green (TGB) and ses- citine (CS) broths, incubated for 18 to 24 h at 43°C and 35°C, respectively. Replicate loopsful of each enrichment culture were streaked on bismuth sulfite (BSA) and Hektoen enteric agar, and incubated at 37°C for 24-48 h. Suspect colonies (3-5) were subjected to biochemicals with triple sugar iron agar after ensuring purity of isolates. Presumptive Salmonella cultures were further tested for urease production, ortho-nitrophenyl-beta-D-Galactopyranoside reaction (5), and lysine decarboxylation (14).

All typical Salmonella cultures were submitted to the National Salmonella Institute of Iraq for serotyping. In an ancillary study, the survival of Enterobacteriaceae in salted casings was assessed at regular intervals. Each casing was then divided into three equal portions for treatment. One portion was treated for Enterobacteri­ aceae using serial ten-fold dilutions prepared in peptone water and plated on red bile agar, plus glucose (VRBG). Following incubation of plates at 35°C for 24 h, the identity of isolates was confirmed as described by Edwards and Ewing (8). The second portion of casing was treated with 50% (w/w) NaCl, whereas the third portion was treated with saturated brine solution. After 18 h of soaking, excess brine was allowed to drain off. Both the salt-cured and brine-cured samples were then stored in containers at room temperature (29°C) for a week. A portion of the salt-cured and brine-cured casings were tested for NaCl by the Volhard method (2). Counts of Enterobacteriaceae were also determined at weekly intervals for up to 3 weeks of storage.

RESULTS AND DISCUSSION

Of 210 samples tested, 34 (16.2%) were found to contain Salmonellae spp. in the three meat products (Table 1). This corresponds to contamination levels of 8.6% and 35% for fresh casings and pasturma sausages, respectively. Of the 3 serovars identified, highest frequency of isolations was obtained with S. anatum. Isolation of S. molade constitutes the first report of this organism from meat products in Iraq. In addition to fresh beef casings (Table 1), chopped meat, spices, or the environment could also have contributed to product contamination (21). Literature provides different figures for the prevalence of Salmonella in raw meats. In 1979, Al-Hindawi and Rished (1) reported a high (51.5%) of Salmo-
nella in raw meats from local shops in Baghdad. Of the 11 serovars reported in their study, 2 were isolated in the present study. Similar rates of isolation from fresh sausages were reported in other national studies (9,11,19,20). The importance of S. typhimurium in the contamination of meat products and in human cases of foodborne Salmonellosis is well established (7,9,21).

The present findings of high levels of contamination in pasturma sausages underlines the health hazard associated with handling of this product by meat-plant workers and consumers. The potential for cross-contamination of ready-to-eat foods in the kitchen cannot be underestimated. Earlier work demonstrated that S. anatum could survive for 3 h on the fingers of plant workers, and that the organism could be isolated from hands following a 13-sec. wash with warm water (16). Further studies are required to estimate the survival of Salmonella in pasturma sausages and to assess the risk associated with Salmonella contamination of commercially available sausages.

Citrobacter freundii, Enterobacter cloacae, Proteus vulgaris, Proteus mirabilis, Escherichia coli and Klebsiella pneumonia were predominant species of Enterobacteriaceae in fresh beef casing. An initial total Enterobacteriaceae count of 1.1 x 10^7 was reduced by 4 log units in samples of salted or brined casing stored for 1 week. Although levels of enteric organisms decreased through the third week of storage, this reduction was not precipitous. These reductions in the bacterial populations appear to be primarily due to the salt level of treated casings. NaCl concentrations in the salted and brined casings were 21.9% and 20.2% respectively. Nielsen and Zeuthen (15) found greater survival of Salmonella in a minced bologna-like meat product treated with 5% NaCl than with 6%. These observations suggest that curing of beef casings prior to use in sausage making is indicated. Several measures can help reduce the potential health hazard associated with Salmonella contaminated raw meat products. These include prompt refrigeration of raw meat products, use of the good manufacturing practices to minimize cross-contamination of products, thorough cleaning and disinfection of cooking apparatus, knives, slicers, counter tops, and working surfaces. An effective control program should also include education of the consumers in the use of hygienic practices in the kitchen and the hazards of consumption of raw or partially cooked meat products.

REFERENCES

Care must be taken to dilute glycol solutions when attempting to enumerate bacterial contaminants, especially at higher incubation temperatures, in order to avoid inhibition of any bacteria present. In a survey of dairy coolants used in Minnesota processing plants, Ginn et al. (7) were able to recover coliforms from glycol coolant samples. The authors did not indicate whether or not the inhibitory effect of glycol was considered. The methods specified by the PMO for the examination of recirculated dairy coolants do not mention the need for diluting glycol/water mixtures to avoid microbial inhibition (2).

The results of this study indicate that \textit{S. typhimurium} can survive in propylene glycol mixtures at low temperatures used in dairy coolants; however, the use of high concentrations of propylene glycol may be effective in reducing the numbers of microorganisms capable of survival in the coolant.

**REFERENCES**

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