

Incidence of Salmonellae in Some Meat Products

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SUMMARY

Fresh pork sausage, biltong, beef mince and chicken carcasses available to the consumer in Pretoria, were examined for salmonellae using standard enrichment, plating and biochemical techniques. The incidence of salmonellae in pork sausage was 40% and in beef mince 64%. The frequent occurrence of salmonellae in biltong (16% of the samples) makes consumption a serious health hazard, since it is eaten raw. Salmonellae were found in 20% of the chicken carcasses, but contamination seemed to be associated mainly with one processor. Where data could be compared with previous local surveys (beef mince and biltong), it appears that the incidence of salmonellae is increasing. The most frequently isolated serotypes of salmonellae in this study were *Salmonella typhimurium* and *Salmonella thompson*. The results indicate the need for greater microbiological control in the meat industry.

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The frequency of salmonella contamination was determined in biltong, pork sausage, beef mince and chicken carcasses available to the consumer in Pretoria. Previous surveys in South Africa of products such as biltong,^{1,2} minced meat,³ and cattle and pig offal^{3,4} destined for human consumption, show that the consumer is frequently exposed to meat contaminated with salmonellae. This survey set out to gain information on the current frequency of salmonella contamination in some meat products and to compare the results with previous surveys.

MATERIALS AND METHODS

Samples of meat products were bought from retail outlets in Pretoria from August 1973 to May 1974. Biltong samples were collected during 1972. The sealed samples were returned to the laboratory, frozen, and stored in the laboratory freezer for an average of 2 days and a maximum of 7 days before analysis. Biltong samples, because of their low water activity, were held at room temperature until analysed.

The thawed samples of meat were prepared for analysis as follows: pork sausage was minced 3 times in a sterilised meat mincer. Biltong was sliced and then comminuted in a sterile blender. Beef mince was not homogenised further.

Salmonellae in beef mince, biltong and pork sausages were detected by the method of Georgala and Boothroyd⁵ as modified by Van Schothorst *et al.*⁶ This involves

the culturing of 20-g aliquots of each meat sample in Tetrathionate broth (Difco) and Selenite F broth (Merck) at both 37°C and 43°C.

Salmonellae were detected in chicken carcasses by shaking the carcass in 300 ml sterile rinsing liquid (0.85% NaCl—0.1% peptone) in a plastic bag for at least 30 seconds, according to the method of Surkiewicz *et al.*⁷ The rinsing liquid was aseptically divided into 4 lots of 75 ml each. Two lots were each added to a flask containing 225 ml of one and one-third strength Selenite F broth and the other two lots were added to 225 ml one and one-third strength Tetrathionate broth. The flasks were incubated and the salmonellae isolated as described for the other meat products.

The South African Institute for Medical Research in Johannesburg typed the presumptive salmonellae.

RESULTS

No meat product was found to be completely free of salmonellae, but contamination was less frequent in chicken carcasses (20% of samples) and biltong (16%) than in pork sausage (40%) and beef mince (64%) (Table I). Salmonellae were more frequently isolated from certain brands of pork sausage, biltong and chicken carcass, suggesting that the contamination is associated with particular processing plants.

No previous surveys of salmonella incidence in pork sausage in South Africa are known, but two recent surveys in the USA reported a frequency of 28%⁸ and 38%.⁹ Rislakki³ isolated salmonellae less frequently from beef mince (9.3% of samples) collected in Pretoria in 1967 and 1968 than did we in the present survey, suggesting that the degree of contamination has increased since then. Two recent surveys in North America did not find salmonellae in beef mince.^{10,11}

The presence of salmonellae in biltong is a very serious health hazard because the product is consumed without cooking. Cases of salmonellosis after consumption of biltong have been reported,^{12,13} and in one instance¹² the patient died. *Salmonella newport* and *Salmonella typhimurium* were implicated in these outbreaks. Compared with previous surveys,^{1,2} where only 0.8% and 3.3% of the biltong samples contained salmonellae, these results suggest that contamination of biltong by salmonellae is increasing.

No difference was found in the frequency of salmonella contamination occurring in fresh and frozen chicken carcasses, and a similar frequency was found in a survey conducted in the USA.⁷

Serotypes *S. typhimurium* and *S. thompson* were most frequently isolated from the meat products, while *S. johannesburg*, *S. london*, *S. adelaide* and *S. newport* were also present (Table II). These isolates are commonly implicated

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TABLE I. INCIDENCE OF SALMONELLAE IN MEAT PRODUCTS

	Biltong	Fresh pork		Chicken carcasses	
		sausage	Beef mince	Refrigerated	Frozen
Number of samples	45	30	11	10	10
Number positive	7*	12*	7*	2†	2†
% positive	16	40	64	20	20

* Number of samples positive for salmonellae in one or more of 20-g aliquots.

† Number of carcasses positive for salmonellae.

TABLE II. NUMBER, TYPE AND SOURCE OF SALMONELLAE ISOLATED

	Biltong	Fresh pork		Chicken carcasses		Total
		sausage	Beef mince	Refrigerated	Frozen	
<i>S. typhimurium</i>	2	4	7	0	0	13
<i>S. thompson</i>	1	4	0	1	2	8
<i>S. johannesburg</i>	3	1	1	0	0	5
<i>S. london</i>	1	2	0	1	0	4
<i>S. newport</i>	0	0	2	1	0	3
<i>S. adelaide</i>	0	1	0	0	0	1

in human salmonellosis outbreaks in South Africa.¹⁴ Richardson *et al.*⁴ isolated all these serotypes from poor quality meat sold in Johannesburg, and found *S. typhimurium*, *S. london* and *S. newport* to be the most frequently isolated serotypes. On the other hand, Rislakki³ found only *S. rimueza* and *S. langenhorn* in minced meat collected from Pretoria butchers. *S. typhimurium* was frequently found in meat products in Britain¹⁵ and the USA.¹⁶ However, many other serotypes not detected in this survey were also frequently isolated from meat products in these countries.

The salmonella serotypes isolated during the present survey represent a wide range of serogroups, but there is no obvious relationship between antigenic structure and the source of the isolate.

These results indicate that the incidence of salmonellae in biltong and beef mince sold to the consumer in Pretoria appears to be increasing. The trend in respect of the frequency of salmonella contamination in chicken carcasses and pork sausage could not be determined, since no earlier local surveys had been made.

Adequate cooking inactivates salmonellae present in raw beef mince, chicken carcasses and pork sausage and therefore greatly reduces the risk of infection from eating these products. However, there remains a danger of salmonellae being spread in the kitchen of the home, restaurant or hospital from infected raw meat to cooked foods. For example, Pether and Gilbert¹⁷ have shown that, under experimental conditions, salmonellae can survive at least 3 hours on the finger tips and are easily transferred from raw to raw and from raw to cooked or processed foods by the hands.

CONCLUSION

Meat and meat products may be contaminated by salmonellae from numerous sources.¹⁵⁻¹⁸ The results of the

present survey indicate that stricter control over the routes of salmonella contamination during the rearing and slaughter of animals and the processing and distribution of carcasses is necessary to improve the safety of meat available to the consumer.

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