

## ***Salmonella* in meat imported from South American countries**

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### INTRODUCTION

The increasing demand for animal proteins in Europe has led to a considerable rise in the importation of meat from South American countries. This importation is not without risk from the public health point of view, since English and Dutch research workers have already pointed out that this meat may be contaminated to a high degree with salmonellas (Hobbs & Wilson, 1959; Hobbs, 1964; Eenink, 1966). The purpose of this investigation was to gain a deeper insight into the degree of contamination in various types of imported meat.

### MATERIALS AND METHODS

Chilled and frozen horsemeat and beef, either carcass meat or boneless, is imported into the Netherlands from South American countries. The investigation reported here concerned chilled carcass horsemeat, frozen carcass and boneless horsemeat and boneless beef. The samples of frozen meat were sampled at twenty-five import stations by the local meat inspectors. The samples of chilled horsemeat originated from only one import station. The investigation was carried out from June 1965 to February 1966.

#### *Method of sampling*

To obtain samples of chilled horsemeat, whole limbs were jointed at the knee. Each lower joint was packed separately in plastic bags and transported directly to the laboratory. In addition, a certain number of joints were thoroughly swabbed with moistened cotton-wool pads in order to examine a greater surface area.

Samples of frozen horsemeat and beef, boneless and carcass, were sawn out or cut out of the blocks of meat using disinfected instruments. The size of the samples was approximately 20 × 10 × 10 cm. The samples were separately packed in plastic bags and transported to the laboratory. In a few instances the samples were not packed separately and the results of examinations on these samples will be reported separately.

#### *Method of examination*

The samples of boneless and carcass meat were placed on a sterile tray and, with sterile instruments, 50 cm.<sup>2</sup> of the superficial layers of connective tissue or of the meat were removed. These severed pieces were used to determine external

contamination. The cut surface of the original sample was then flamed and sampled once more. Scissors and forceps were used for chilled meat and a drill for frozen meat to obtain samples of approximately 20 g. When the size of a sample was too small for proper internal examination it was examined twice externally. This means that instead of 50 cm<sup>2</sup> an area of 100 cm<sup>2</sup> of the surface was examined for *Salmonella*.

The salmonella examination was carried out by enrichment of 50 cm.<sup>2</sup> of the surface of each sample or 20 g. of the interior of the sample in the media of Müller-Kauffmann and Osborne-Stokes (Osborne & Stokes, 1955). After 24 and 72 hr. incubation at 37° C. the cultures were streaked on brilliant green-phenol red agar plates (diameter 14 cm.) which were examined after 18-24 hr. incubation at 37° C. (Guinée & Kampelmacher, 1962).

## RESULTS

From nine different batches of chilled carcass horsemeat, all originating from one single firm in Argentina, 108 samples (12 per batch) were examined over a period of 2 months. Moreover, complete joints of five of these batches were examined externally by swabbing. No salmonellas were isolated from these samples.

Table 1. *Salmonella* in frozen horse meat

Country of Origin	No. of samples examined	Samples positive		Samples examined once externally and once internally			Samples examined twice externally			
		No.	%	Positive			Positive			
				No.	Ext.	Int.	Both	No.	One	Both
Boneless meat										
Argentina	76	41	54	58	13	0	17	18	8	3
Brazil	8	3	37	7	2	0	0	1	1	0
Uruguay	212	126	59	119	47	1	20	93	34	24
Total	296	170	57	184	62	1	37	112	43	27
Carcass meat										
Argentina	264	28	10	241	20	3	1	23	3	1
Brazil	17	0	0	16	0	0	0	1	0	0
Uruguay	80	28	35	76	25	0	3	4	0	0
Total	361	56	15	333	45	3	4	28	3	1
Not specified										
Argentina	143	52	36	97	13	2	5	46	18	14
General total	800	278	34.7	614	172 (28.0%)			186	106 (56.9%)	

A total of 296 samples of frozen boneless and 361 samples of frozen carcass horsemeat originating from Argentina, Brazil and Uruguay were examined. It was not possible to ascertain the numbers of different batches from which these samples originated. In addition 143 samples of frozen horsemeat from Argentina

were examined; it was not possible to ascertain whether the meat was boneless or not. The results of these examinations are summarized in Table 1.

Of frozen boneless beef originating from Argentina, Brazil and Uruguay, 751

Table 2. *Salmonella* in frozen beef (boneless)

Country of origin	No. of samples examined	Samples positive		Samples examined once externally and once internally		
		No.	%	External only positive	Internal only positive	Both positive
Argentina	563	59	10	54	0	5
Brazil	28	0	0	0	0	0
Uruguay	160	42	26	28	4	10
Total	751	101	13	82	4	15

Table 3. Frequency of *Salmonella* serotypes isolated from frozen horsemeat and beef

	Frozen horse meat	Beef
<i>S. anatum</i>	133	33
<i>S. minnesota</i>	115	8
<i>S. oranienburg</i>	83	4
<i>S. typhi murium</i>	36	27
<i>S. good</i>	33	1
<i>S. newport</i>	25	35
<i>S. raus</i>	19	1
<i>S. montevideo</i>	16	6
<i>S. haelsingborg</i>	12	0
<i>S. derby</i>	12	8
<i>S. saint paul</i>	11	3
<i>S. muenchen</i>	8	0
<i>S. siegburg</i>	8	0
<i>S. vaertan</i>	8	0
<i>S. meleagridis</i>	6	2
<i>S. oldenburg</i>	2	0
<i>S. stanley</i>	2	0
<i>S. dublin</i>	1	0
<i>S. san diego</i>	1	3
<i>S. java</i>	1	0
<i>S. bovis morbificans</i>	1	4
<i>S. haifa</i>	1	0
<i>S. cerro</i>	1	0
<i>S. bredeney</i>	0	3
<i>S. panama</i>	0	2
<i>S. give</i>	0	1
<i>S. infantis</i>	0	1
<i>S. livingstone</i>	0	1

samples were examined. Again it was impossible to ascertain the numbers of different batches from which the samples were taken. The results of these examinations are summarized in Table 2.

Table 3 shows the frequency of *Salmonella* serotypes isolated from frozen horsemeat and beef.

The results of the examinations of a number of samples which were not packed separately are given in Table 4.

Table 4. *Prevalence of Salmonella in the samples of frozen boneless horsemeat which were not packed separately and were externally examined twice*

Country of origin	Number of samples examined	1 × positive	2 × positive
Argentina	43	5	38
Frequency of types			
<i>S. typhi murium</i>	37	<i>S. muenchen</i>	3
<i>S. minnesota</i>	23	<i>S. san diego</i>	3
<i>S. anatum</i>	18	<i>S. meleagridis</i>	3
<i>S. oranienburg</i>	18	<i>S. montevideo</i>	1
<i>S. gaminara</i>	5	<i>S. saint paul</i>	1
<i>S. newport</i>	3	<i>S. cerro</i>	1

#### DISCUSSION

It is clear from the results that the method of examination strongly influences the number of positive results obtained. For example, the percentage of positive results among samples of frozen boneless and carcass horsemeat varied from 28.0 to 56.9, depending on whether one or two external examinations were carried out. Comparisons therefore between different countries of origin or between the different conditions of importation is only possible when the method of examination is uniform throughout. When a comparison is made between the samples which were examined once externally and once internally then the absence of salmonellas from the samples of chilled horsemeat is striking. All these samples originated from the same slaughterhouse in Argentina.

Out of 184 samples of frozen boneless horsemeat 99 (53%) were found to be positive externally, while of 333 samples of carcass meat only 49 (14%) were positive externally. There was also a striking difference between the number of samples positive internally, 38 (20%) of frozen boneless compared with 7 (2%) of carcass samples of horsemeat. It is clear from these results that contamination in the slaughterhouse is an important factor.

The pattern of contamination of the samples of frozen boneless beef agreed broadly with that found for positive samples of carcass horsemeat: 12% were externally and 2% were internally positive.

When the countries of origin were considered Uruguay showed the highest percentage of contaminated samples. The results shown in Table 4 are of special interest; they indicate that unhygienic handling of the meat (in this case contact between parts of different samples) can increase the percentage of contamination up to 100 when two external samples are examined.

The percentage of contaminated samples of Argentina frozen boneless meat agrees well with the results obtained by Hobbs (1964). The percentages of positive

results found by this author for the period 1961–63 were 43 for horsemeat, 54 for horse offal and 15 for beef. Furthermore, the *Salmonella* types found in our study agree well with those found in England. Three of the four most frequently isolated types from horsemeat were the same. For beef the three most frequently isolated types were the same.

Considering the ten types most frequently isolated from minced meat in the Netherlands (Report 1966) and the serotypes listed in Table 3, it is apparent that six of the ten are the same as the seven most frequently isolated types from South American frozen meat. This agreement between the types found leads to the suspicion that meat imported from South American countries is not only used in the meat industry but also by butchers in the preparation of minced meat.

It is evident from the investigations by Hobbs (1964) as well as from those reported here, that slaughterhouse practice plays a very important role in establishing these high rates of contamination. From the public health point of view, we are dealing with a difficult situation, since measures to prevent contamination have to be taken in the country of origin.

#### SUMMARY

Salmonellas were isolated from 278 of 800 (34.7%) samples of frozen carcass or boneless horsemeat from South America and from 101 of 751 (13.5%) samples of frozen boneless beef. However, the percentage of contamination detected depends to a large degree on the method of examination. Contamination was mostly external, a fact which points to slaughterhouse contamination. Boneless meat was contaminated to a higher degree than carcass meat.

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