

Chapter 4

REPORTS OF *SALMONELLA* IN ANIMAL FEEDINGSTUFFS

1) COMPOUND ANIMAL FEEDINGSTUFFS

In 1989, as part of its package of measures to control *Salmonella* in animals, particularly poultry, the Department, with the co-operation of the feedingstuffs industry, introduced a number of voluntary Codes of Practice for the hygienic production, storage, handling and transport of animal feedingstuffs (Defra 1989). The Codes contain measures for the testing of animal feedingstuffs for *Salmonella*, and the adoption of the Codes by all the major animal feedingstuff companies in Great Britain has resulted in a large volume of testing being undertaken each year.

This chapter contains details on the results of that testing including the number of samples of various categories of feedingstuffs tested for *Salmonella*, the number of samples that proved positive and the contamination rate (Table 71). This table indicates no change in the overall contamination rate in animal feedingstuffs between 2002 and 2003. The number of tests carried out (37% increase in numbers from 2002), particularly on feed ingredients, was considerably higher compared with the previous year, but was still 27% lower than the number carried out in 2001.

Tables 72 and 73 give results of *S. Typhimurium* and *S. Enteritidis* isolations from feedingstuffs. They show that the number of isolations of these serovars from feedingstuffs is low (2 and 15 isolates respectively of 40,213 tests carried out – in 2002 the respective figures were 0 and 6).

Tables 74 to 76 suggest that a previous problem relating to contamination of compound feeds with *S. Agona* originating from the vegetable oil extraction process has reduced further during 2003, although the organism was still regularly recovered from soya, rape and other feed ingredients (Table 77). *S. Anatum*, *S. Mbandaka* and *S. Senftenberg* were the most frequently isolated serovars from ruminant, pig and poultry compound feeds respectively in 2003. As usual a wide range of other serovars were found in feed ingredients, reflecting their diversity of origin. Examples of the risk of introducing *Salmonella* serovars of potential public health significance in feed ingredients are provided by the isolation of *S. Typhimurium* in maize and soya.

A small number of feed isolates were not fully typed as reports rather than isolates were supplied by the testing laboratories.

2) PROCESSED ANIMAL PROTEIN

Processed animal protein is subject to statutory testing schemes at the point of production or importation and voluntary testing is also undertaken, mainly by feed mills receiving the material, where typically higher rates of contamination are found.

The feeding of mammalian meat and bone meal (MBM) to all farmed livestock was made illegal from 4 April 1996 and this resulted in much of it being disposed of by burial or incineration. As such, it no longer fell within the definition of "processed animal protein" as defined in the Processed Animal Protein Order 1989 (replaced by the Animal By-Products Order, 1999) and producers were no longer under a legal obligation to test products for *Salmonella* on each day they were consigned from their premises. However, official quarterly testing of products has continued under the Animal By-Products Order 1992, and since under the Animal By-Products Order 1999. The Animal By Products Regulations 2003 are due to be implemented on July 1st 2003.

From 1 August 2001, under the Processed Animal Protein Regulations 2001, the feeding of processed animal protein to animals kept, fattened or bred for the production of food is prohibited, with some exceptions including non-ruminant gelatin used for coating feed additives, animal-derived dicalcium phosphate and hydrolysed protein produced under certain conditions when fed to non-ruminants; fishmeal produced under certain conditions may be fed farmed animals other than ruminants. Table 78 details the results obtained from the statutory official testing of domestic processed animal protein.

There has been an increase in the numbers of batches of domestically produced processed animal protein tested in 2003 (152) compared with 2002 (93). In 2003 the overall contamination rate rose to 5.9% from 1.1% in 2002.

The contamination rate of 10.8% of imported animal proteins (Table 80) was lower than that in 2002 (16.3%). It is also worthy of note that slightly fewer tests were carried out: 130 in 2003 as opposed to 147 in 2002.

Trends in contamination rates for domestically processed and imported animal proteins are shown in Figure 43 and Figure 44 respectively.

A wide range of serovars was again recorded. Of note in 2003 is the presence of *S. Enteritidis* in imported feed ingredients. In view of the risk of multiple antibiotic resistance strains of *Salmonella* such as *S. Newport* and *S. Paratyphi B* var *Java* or new phage types of *S. Enteritidis* it is

important to maintain thorough surveillance testing of imported feed ingredients.

**Table 71: Animal feedingstuffs and ingredients contamination rates
(Tests being performed under the Animal By-Products Order 1999 and
Defra Codes of Practice) 2002 - 2003**

Product	2002			2003		
	No of tests	No of tests positive	Percent positive	No of tests	No of tests positive	Percent positive
Processed animal protein at a GB protein processing premises	3318	41	1.2	3752	21	0.6
GB and imported processed animal protein arriving for feedingstuffs use	967	33	3.4	878	23	2.6
Oilseed meals and products for feedingstuffs use	6035	258	4.3	12475	376	3.0
Non-oilseed meal vegetable products	4038	26	0.6	9954	97	1.0
Ruminant concentrates	2336	23	1.0	1859	6	0.3
Pig extrusions	2057	12	0.6	1411	13	0.9
Pig and poultry meals	4034	54	1.3	4171	33	0.8
Poultry extrusions	5183	24	0.5	4346	21	0.5
Protein concentrate	726	12	1.6	724	6	0.8
Minerals/other	641	0	0	643	1	0.2
Total	29335	483	1.6	40213	597	1.5

Table 72: *Salmonella* Enteritidis and *S. Typhimurium* in feedingstuff ingredients 2002 - 2003

Type of Material	2002		2003	
	S. Enteritidis	S. Typhimurium	S. Enteritidis	S. Typhimurium
Finished feeds	-	1	1	2
Animal protein	-	-	-	-
Vegetable material	-	5	-	3
Minerals	-	-	-	-
Miscellaneous	-	-	1	10
Total	-	6	2	15

Table 73: Isolations of *S. Enteritidis* and *S. Typhimurium* from products monitored under the Defra Codes of Practice, 2002

<i>Salmonella</i> serotype	Number	Number
Typhimurium	1	1
	2	2
	1	1
	2	2

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Table 74: The top 3 serotypes of *Salmonella* isolated from compound ruminant feed in 2003, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2002	<i>Salmonella</i> serotype	Isolations 2003
Mbandaka	6	Anatum	2
Senftenberg	5	Livingstone	1
Rissen	2	Mbandaka	1
		Meleagridis	1
		Senftenberg	1

Table 75: The top 4 serotypes of *Salmonella* isolated from compound pig feed in 2003, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2002	<i>Salmonella</i> serotype	Isolations 2003
Mbandaka	8	Mbandaka	4
Kedougou	7	Anatum	3
Agona	6	Agona	2
Havana	2	4,12:b:-	2

Table 76: The top 4 serotypes of *Salmonella* isolated from compound poultry feed in 2003, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2002	<i>Salmonella</i> serotype	Isolations 2003
Mbandaka	8	Senftenberg	8
Ohio	7	Agona	4
Senftenberg	6	Kentucky	3
Rissen	3	Derby	3
		3,10:y:-	3
		Ohio	2

Table 77: The major serotypes of *Salmonella* in feedingstuff ingredients 2003, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations 2002	Isolations 2003
Barley	Agama	0	1
	Mississippi	0	1
	Untyped	1	1
Cocoa	Hull	1	0
	Ibadan	0	1
	Kuessel	0	1
	Lexington	1	0
	Mississippi	0	1
	Morningside	0	1
	Untyped	1	1
Cotton	Agona	1	0
	Cubana	1	0
	Lexington	0	0
	Untyped	1	0
Linseed	Abony	1	0
	Derby	1	0
	Mbandaka	13	7
	Senftenberg	1	0
	Tennessee	5	0
	Untyped	8	0
Maize	Agona	2	2
	Havana	1	1
	Infantis	0	1
	Kedougou	3	1
	Liverpool	1	0
	Livingstone	1	0
	Rissen	1	0
	Schwarzengrun	0	3
	Tennessee	0	1
Typhimurium	2	1	
Oats	Agona	1	0
	Essen	1	0
	Untyped	1	0
Palm Kernel	Agona	1	0
	Albany	3	2
	Ansterdam	0	1
	Cannstatt	0	1
	Carno	2	0
	Cubana	6	1
	Java	1	0
	Kentucky	1	0
	Lexington	0	1
	Mbandaka	3	0

Table 77 (continued): The major serotypes of *Salmonella* in feedingstuff ingredients 2003, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations 2002	Isolations 2003
	Meleagridis	1	0
	Poona	1	0
	Rissen	1	1
	Ruiru	1	0
	Schoeneberg	1	0
	Senftenberg	1	0
	Tees	2	0
	Yoruba	2	0
	Untyped	4	0
Rape	Agama	0	3
	Agona	21	55
	Binza	0	1
	Cubana	0	2
	Derby	0	3
	Ealing	1	0
	Essen	3	0
	Havana	1	0
	Idikan	0	1
	Livingstone	0	1
	Mbandaka	44	26
	Rissen	1	0
	Saint Paul	0	0
	Senftenberg	3	2
	Taksony	2	0
	Tennessee	4	14
	Typhimurium	1	0
	Virchow	1	0
	4,12:b:-	0	1
	Untyped	12	0
Rice Bran	Typhimurium	0	1
Soya	Agona	17	26
	Anatum	0	4
	Binza	0	0
	California	0	1
	Cubana	4	2
	Derby	0	2
	Essen	6	0
	Fresno	0	3
	Hadar	0	1
	Havana	3	4
	Heidelberg	0	0
	Infantis	0	1
	Kedougou	1	0
	Kentucky	1	0
	Kiel	1	0
	Kingston	0	1
	Lexington	0	5

Table 77 (continued): The major serotypes of *Salmonella* in feedingstuff ingredients 2003, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations	Isolations
		2002	2003
Feedingstuff	Lille	1	0
	Livingstone	0	5
	Mbandaka	20	24
	Meleagridis	1	1
	Montevideo	0	1
	Oranienburg	0	1
	Ouakam	0	2
	Poona	1	0
	Rissen	6	10
	Senftenberg	15	13
	Stanley	1	1
	Tennessee	9	7
	Typhimurium	0	2
	Worthington	0	1
	Yoruba	2	4
	4,12:d:-	0	2
	6,7:-:-	0	1
	Untyped	24	6
	Sunflower	Agona	0
Emek		0	1
Kedougou		1	1
Livingstone		0	1
Mbandaka		3	8
Meleagridis		2	0
Oranienburg		0	1
Ouakam		0	1
Senftenberg		1	3
Tennessee		0	3
Untyped		3	0
Wheat	Agona	3	1
	Cerro	1	0
	Havana	1	0
	Lexington	1	0
	Newport	0	1
	Rissen	2	0
	Stourbridge	0	1
	Typhimurium	2	0
	Virchow	0	0
	Yoruba	0	2
Fishmeal	Albany	0	1
	Altona	0	0
	Anatum	0	1
	Binza	1	0
	Cerro	0	0
	Cubana	0	1
	Fresno	2	0
	Isangi	0	1
	Lille	1	0

Table 77 (continued): The major serotypes of *Salmonella* in feedingstuff ingredients 2003, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations	Isolations
		2002	2003
Feedingstuff	Montevideo	2	1
	Ohio	4	0
	Oranienburg	0	3
	Ouakam	0	1
	Rissen	2	0
	Senftenberg	1	0
	Tennessee	0	2
	Thompson	1	0
	Untyped	1	0
Milk powder	Cerro	1	0
Other	Agama	0	1
	Agona	1	33
	Anatum	0	2
	Binza	1	0
	Cerro	0	1
	Cubana	1	1
	Derby	1	1
	Essen	1	0
	Havana	0	5
	Infantis	0	1
	Kedougou	0	2
	Kentucky	1	0
	Kottbus	0	2
	Lexington	0	1
	Mbandaka	3	3
	Montevideo	0	1
	Muenster	0	1
	Newport	0	2
	Ohio	0	1
	Panama	0	1
	Rissen	0	3
	Senftenberg	3	3
	Stockholm	0	1
	Stourbridge	0	1
	Typhimurium	0	4
	Westhampton	0	1
	Untyped	3	2
Mill environment	Agama	0	1
	Agona	0	2
	Binza	0	0
	Lille	1	0
	Mbandaka	6	0
	Untyped	1	0
Unspecified	Agama	0	4
	Agona	0	8
	Anatum	0	2
	Cerra	0	1

Table 77 (continued): The major serotypes of *Salmonella* in feedingstuff ingredients 2003, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations	Isolations
		2002	2003
	Cubana	0	2
	Derby	0	3
	Dublin	0	2
	Enteritidis	0	2
	Give	1	0
	Hadar	0	0
	Havana	0	2
	Infantis	0	3
	Isangi	0	4
	Kedougou	0	2
	Lexington	0	1
	Liverpool	0	1
	Livingstone	0	1
	Manhattan	0	1
	Mbandaka	2	4
	Ohio	0	1
	Oranienburg	0	1
	Ouakam	0	1
	Pona	0	1
	Rissen	0	3
	Senftenberg	1	6
	Taksony	0	3
	Tennessee	1	10
	Typhimurium	0	5
	Untyped	1	0

Table 78: Animal By-Products Order 1999 - domestic protein official testing - contamination rates in 2003 compared with the previous year

Sample Type	Batches Tested in 2002			Batches Tested in 2003		
	No	+ve	% +ve	No	+ve	% +ve
Poultry Offal Meal	19	1	5.3	25	1	4.0
Bone Meal	-	-	-	-	-	-
Blood Meal	1	0	-	-	-	-
Meat & Bone Meal	16	0	-	30	6	20.0
Greaves	5	0	-	16	0	-
Herring Meal	4	0	-	4	0	-
Other Fish Meal	15	0	-	12	2	16.7
White Fish Meal	6	0	-	11	0	-
Others	27	0	-	54	0	-
Total	93	1	1.1	152	9	5.9

NB: This table excludes the results of private testing

**Fig 43: Contamination rate - domestic processed animal protein
(official and private testing - batches) 1994 - 2003**

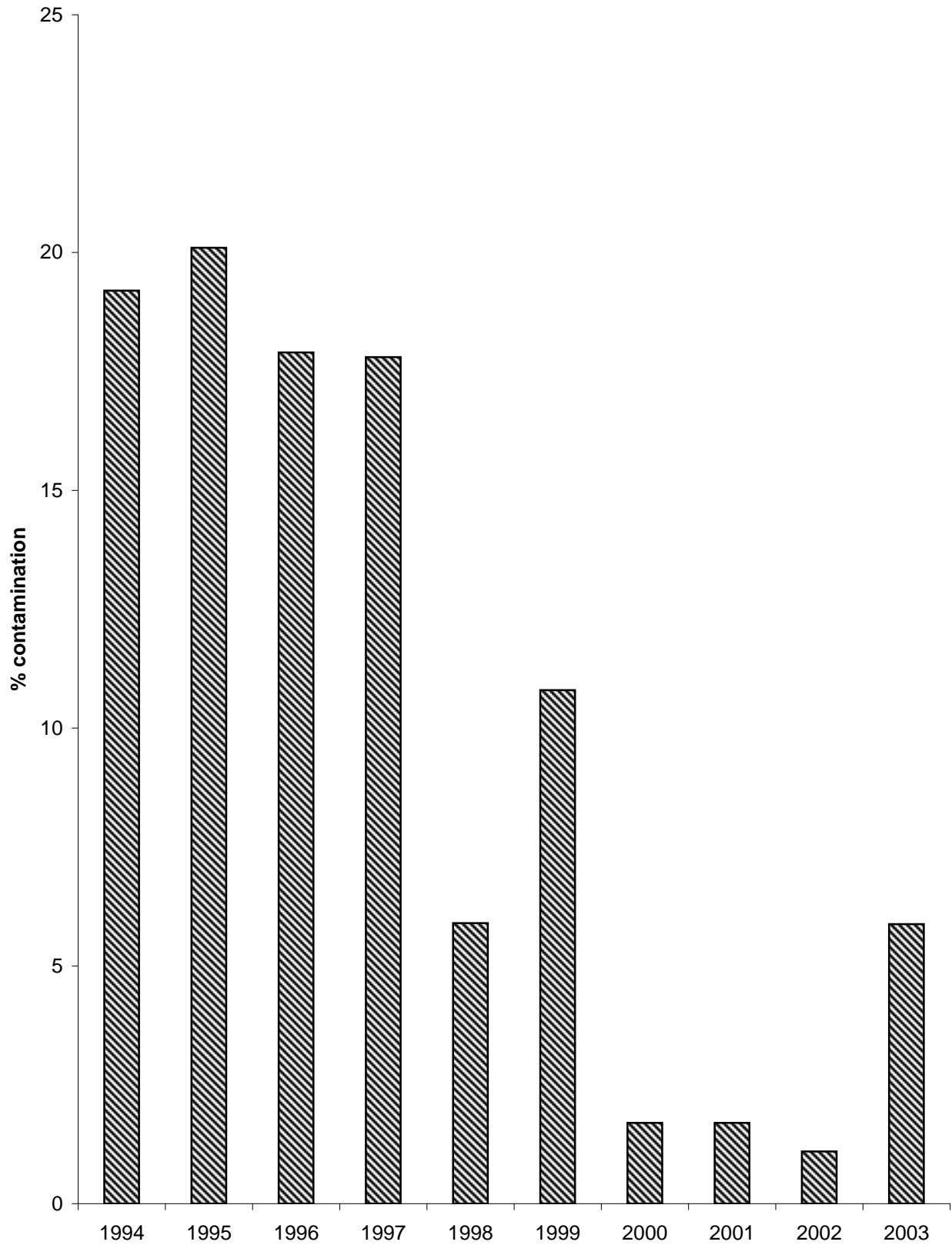


Table 79: Animal By-Products Order 1999 - serotypes isolated during 2003 from official and private testing of domestic protein, compared with previous year

<i>Salmonella</i> serotype	Isolations 2002	<i>Salmonella</i> serotype	Isolations 2003
Kedougou	1	Tennessee	5
		Montevideo	1
		6,7:-:-	1
		Group B	1
		Untyped	3
Total isolations	1	Total isolations	11
No. of positive batches	1	No. of positive batches	9

Table 80: The Importation of Processed Animal Protein Order, 1981 - imported protein contamination rates in 2003, compared with the previous year

Sample Type	Batches Tested in 2002			Batches Tested in 2003		
	No	+ve	% +ve	No	+ve	% +ve
Meat & Bone Meal	19	5	26.3	23	7	30.4
Greaves	4	1	25.0	-	-	-
Fish Meal	118	18	15.3	102	7	6.9
Others	6	0	-	5	0	-
Total	147	24	16.3	130	14	10.8

**Fig 44: Contamination rate: imported processed animal protein
(batches tested) 1994 - 2003**

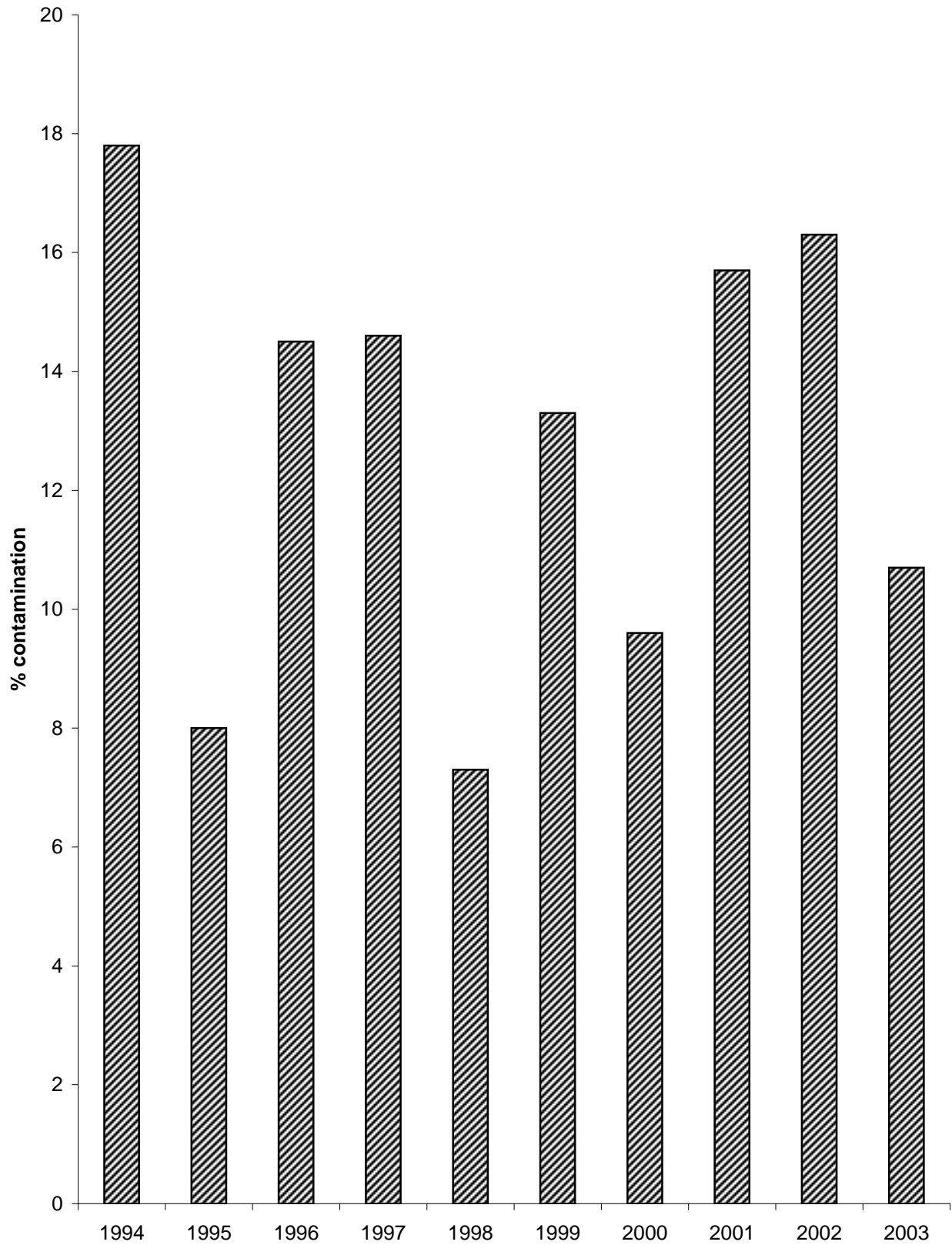


Table 81: The Importation of Processed Animal Protein Order, 1981 - serotypes isolated during 2003 from imported protein, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2002	<i>Salmonella</i> serotype	Isolations 2003
Montevideo	3	Enteritidis	6
Anatum	2	Isangi	4
Havana	2	Anatum	2
Poona	2	Cerro	1
Senftenberg	2	Dublin	2
Enteritidis	1	Infantis	1
Kedougou	1	Livingstone	1
Livingstone	1	Manhattan	1
Newington	1	Senftenberg	1
Ohio	1		
Tennessee	1	Group B	1
Typhimurium	1	Group C	1
6,7:-:-	1		
Group E	3		
Group C	2		
Group B	1		
Group G	1		
Total isolations	26	Total isolations	21
No. of positive batches	24	No. of positive batches	24