

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 2001 and 2002. The number of tests carried out (47% decrease in numbers from 2001), particularly on feed ingredients, was considerably reduced compared with the previous year.

Tables 72 and 73 give results of *S. Typhimurium* and *S. Enteritidis* isolations from feedingstuffs. They show that the number of isolations of these serotypes from feedingstuffs is very low (0 and 6 isolates respectively of 29,335 tests carried out – in 2001 the respective figures were 3 and 9). This continues an ongoing trend in reduction of contamination by *S. Enteritidis* in particular, which reflects reduced infection found in animals and humans. Most of the *S. Typhimurium* isolates were from grain based ingredients but one was from compound pig feed.

Tables 74 to 76 suggest that the previous problem relating to contamination of compound feeds with *S. Agona* originating from the vegetable oil extraction process reduced further during 2002, although the organism was still regularly recovered from soya, rape and other feed ingredients (Table 77). *S. Mbandaka* was the most frequently isolated serotype from compound feed in 2002 and this reflected a substantial increase in the number of isolates from rape, obtained despite the reduced testing. *S. Mbandaka* was also regularly reported from soya and linseed based ingredients. As usual a wide range of other serotypes were found in feed ingredients, reflecting their diversity of origin. Examples of the risk of introducing *Salmonella* serotypes of potential public health significance in feed ingredients are provided by

the isolation of *S. Typhimurium* in maize, wheat and rape; *S. Virchow* in rape and *S. Stanley* in soya. *S. Paratyphi B* var Java, currently a major problem in poultry in some parts of Europe but not yet found in animals in the UK, was isolated from imported palm kernel. This may be consistent with the reported infection of free-living reptile populations in some parts of the world where this material is produced.

A 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 2002 (93) compared with 2001 (59), but this is slightly less than the numbers tested for 2000, when 117 batches were tested. The overall 1.1% contamination rate is little different to the 1.7% rate in 2001.

The contamination rate of 16.3% of imported animal proteins (Table 80) was greater than that in 2001 (15.7%). It is also worthy of note that slightly more tests were carried out: 147 in 2002 as opposed to 134 in 2001.

Trends in contamination rates of domestically processed animal proteins are shown in Figure 43. The chart indicates the downward trends in the rate of contamination since 1993, to a very low level of contamination currently. This contrasts with Figure 44 which shows an increased level of contamination of imported animal proteins compared with that found in 1993. This may reflect the standards of production and the targeting of increased sampling for sources with a previous history of significant contamination.

A wide range of serotypes was again recorded. Of note in 2002 is the presence of an isolate of each of *S. Typhimurium* and *S. Enteritidis*. 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) 2001 - 2002**

Product	2001			2002		
	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	5866	128	2.2	3318	41	1.2
GB and imported processed animal protein arriving for feedingstuffs use	1350	33	2.4	967	33	3.4
Oilseed meals and products for feedingstuffs use	14482	323	2.2	6035	258	4.3
Non-oilseed meal vegetable products	14370	227	1.6	4038	26	0.6
Ruminant concentrates	2655	24	0.9	2336	23	1.0
Pig extrusions	2124	8	0.4	2057	12	0.6
Pig and poultry meals	5274	58	1.1	4034	54	1.3
Poultry extrusions	6320	27	0.4	5183	24	0.5
Protein concentrate	805	12	1.5	726	12	1.6
Minerals/other	1837	18	1.0	641	0	0
Total	55083	858	1.6	29335	483	1.6

Table 72: *Salmonella* Enteritidis and *S. Typhimurium* in feedingstuff ingredients 2001 - 2002

Type of Material	2001		2002	
	S. Enteritidis	S. Typhimurium	S. Enteritidis	S. Typhimurium
Finished feeds	2	4	-	1
Animal protein	1	-	-	-
Vegetable material	1	3	-	5
Minerals	-	-	-	-
Miscellaneous	-	2	-	-
Total	3	9	-	6

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

<i>Salmonella</i> serotype	Feedingstuff	Number
Typhimurium	pig compound feed	1
	maize	2
	rape	1
	wheat	2

Table 74: The top 3 serotypes of *Salmonella* isolated from compound ruminant feed in 2002, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2001	<i>Salmonella</i> serotype	Isolations 2002
Mbandaka	4	Mbandaka	6
Binza	2	Senftenberg	5
Derby	2	Rissen	2
Newington	2		

Table 75: The top 4 serotypes of *Salmonella* isolated from compound pig feed in 2002, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2001	<i>Salmonella</i> serotype	Isolations 2002
Agona	6	Mbandaka	8
Mbandaka	4	Kedougou	7
Newington	4	Agona	6
Lexington	3	Havana	2

Table 76: The top 4 serotypes of *Salmonella* isolated from compound poultry feed in 2002, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2001	<i>Salmonella</i> serotype	Isolations 2002
Binza	4	Mbandaka	8
Mbandaka	4	Ohio	7
Ohio	3	Senftenberg	6
Tennessee	3	Rissen	3

Table 77: The major serotypes of *Salmonella* in feedingstuff ingredients 2002, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations 2001	Isolations 2002
Barley	Kedougou	1	0
	Untyped	0	1
Cocoa	Hull	0	1
	Lanka	1	0
	Lexington	0	1
	Reading	1	0
	Untyped	4	1
Copra	Ruiru	1	0
	Untyped	1	0
Cotton	Agona	0	1
	Cubana	0	1
	Lexington	1	0
	Untyped	0	1
Linseed	Abony	0	1
	Agona	2	0
	Braenderup	8	0
	Derby	0	1
	Djugu	3	0
	Fortune	2	0
	Mbandaka	41	13
	Newington	1	0
	Rissen	1	0
	Senftenberg	0	1
	Tennessee	0	5
	Untyped	13	8
Maize	Agona	1	2
	Albany	1	0
	Havana	0	1
	Kedougou	1	3
	Liverpool	0	1
	Livingstone	0	1
	Rissen	0	1
	Senftenberg	2	0
Typhimurium	0	2	
Oats	Agona	0	1
	Essen	0	1
	Mbandaka	1	0
	Senftenberg	1	0
	Untyped	0	1
Palm Kernel	Agona	0	1
	Albany	0	3
	Bergen	1	0
	Carno	0	2

Table 77 (continued): The major serotypes of *Salmonella* in feedingstuff ingredients 2002, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations 2001	Isolations 2002
	Cubana	1	6
	Java	0	1
	Kentucky	0	1
	Mbandaka	0	3
	Meleagridis	0	1
	Poona	0	1
	Rissen	0	1
	Ruiru	1	1
	Schoeneberg	0	1
	Senftenberg	0	1
	Tees	0	2
	Yoruba	0	2
	Untyped	0	4
Rape	Agona	10	21
	Cubana	1	0
	Derby	4	0
	Ealing	0	1
	Essen	0	3
	Havana	0	1
	Idikan	1	0
	Lexington	3	0
	Mbandaka	12	44
	Newington	4	0
	Rissen	0	1
	Saint Paul	2	0
	Senftenberg	1	3
	Taksony	0	2
	Tennessee	10	4
	Typhimurium	0	1
	Virchow	0	1
	Untyped	5	12
Soya	Agona	20	17
	Binza	2	0
	Cubana	11	4
	Essen	0	6
	Havana	1	3
	Heidelberg	1	0
	Kedougou	0	1
	Kentucky	0	1
	Kiel	1	1
	Lexington	2	0
	Lille	0	1
	Livingstone	1	0
	Mbandaka	45	20
	Meleagridis	1	1
	Ouakam	1	0
	Poona	1	1
	Rissen	3	6

Table 77 (continued): The major serotypes of *Salmonella* in feedingstuff ingredients 2002, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations	Isolations
		2001	2002
Feedingstuff	Senftenberg	4	15
	Stanley	0	1
	Tennessee	11	9
	Worthington	1	0
	Yoruba	3	2
	Untyped	8	24
	Sunflower	Kedougou	0
Mbandaka		10	3
Meleagridis		0	2
Senftenberg		0	1
Tennessee		4	0
Untyped		3	3
Wheat	Agona	0	3
	Binza	1	0
	Cerro	0	1
	Havana	0	1
	Lexington	0	1
	Rissen	0	2
	Typhimurium	3	2
	Virchow	1	0
	Untyped	1	0
Fishmeal	Altona	1	0
	Binza	0	1
	Blockley	1	0
	Cerro	1	0
	Derby	1	0
	Enteritidis	1	0
	Falkensee	2	0
	Fresno	0	2
	Give	1	0
	Hadar	1	0
	Infantis	2	0
	Livingstone	1	0
	Lille	0	1
	London	1	0
	Meleagridis	1	0
	Montevideo	0	2
	New Haw	1	0
	Ohio	3	4
	Rissen	1	2
	Senftenberg	1	1
	Tennessee	6	0
	Thompson	0	1
	Untyped	3	1
Milk powder	Cerro	0	1

Table 77 (continued): The major serotypes of *Salmonella* in feedingstuff ingredients 2002, compared with the previous year

Feedingstuff	<i>Salmonella</i> serotype	Isolations 2001	Isolations 2002
Other	Agama	1	0
	Agona	3	1
	Binza	0	1
	Cerro	1	0
	Chandans	1	0
	Cubana	2	1
	Derby	0	1
	Essen	0	1
	Havana	1	0
	Kedougou	2	0
	Kentucky	0	1
	Langford	1	0
	Mbandaka	4	3
	Newington	1	0
	Nottingham	1	0
	Ohio	1	0
	Oranienburg	2	0
	Poona	1	0
	Senftenberg	3	3
	Tennessee	2	0
Typhimurium	1	0	
Worthington	1	0	
Untyped	2	3	
Mill environment	Binza	5	0
	Heidelberg	1	0
	Kedougou	2	0
	Lille	0	1
	Mbandaka	3	6
	Montevideo	2	0
	Ohio	2	0
	Typhimurium	1	0
	Untyped	0	1
Unspecified	Give	0	1
	Hadar	1	0
	Lexington	1	0
	Mbandaka	3	2
	Senftenberg	1	1
	Tennessee	0	1
	Untyped	0	1

Table 78: Animal By-Products Order 1999 - domestic protein official testing - contamination rates in 2002 compared with the previous year

Sample Type	Batches Tested in 2001			Batches Tested in 2002		
	No	+ve	% +ve	No	+ve	% +ve
Poultry Offal Meal	12	0	-	19	1	5.3
Bone Meal	1	0	-	-	-	-
Blood Meal	1	0	-	1	0	-
Meat & Bone Meal	3	0	-	16	0	-
Greaves	9	0	-	5	0	-
Herring Meal	2	0	-	4	0	-
Other Fish Meal	9	0	-	15	0	-
White Fish Meal	21	1	4.8	6	0	-
Others	1	0	-	27	0	-
Total	59	1	1.7	93	1	1.1

NB: This table excludes the results of private testing

**Fig 43: Contamination rate - domestic processed animal protein
(official and private testing - batches) 1993 - 2002**

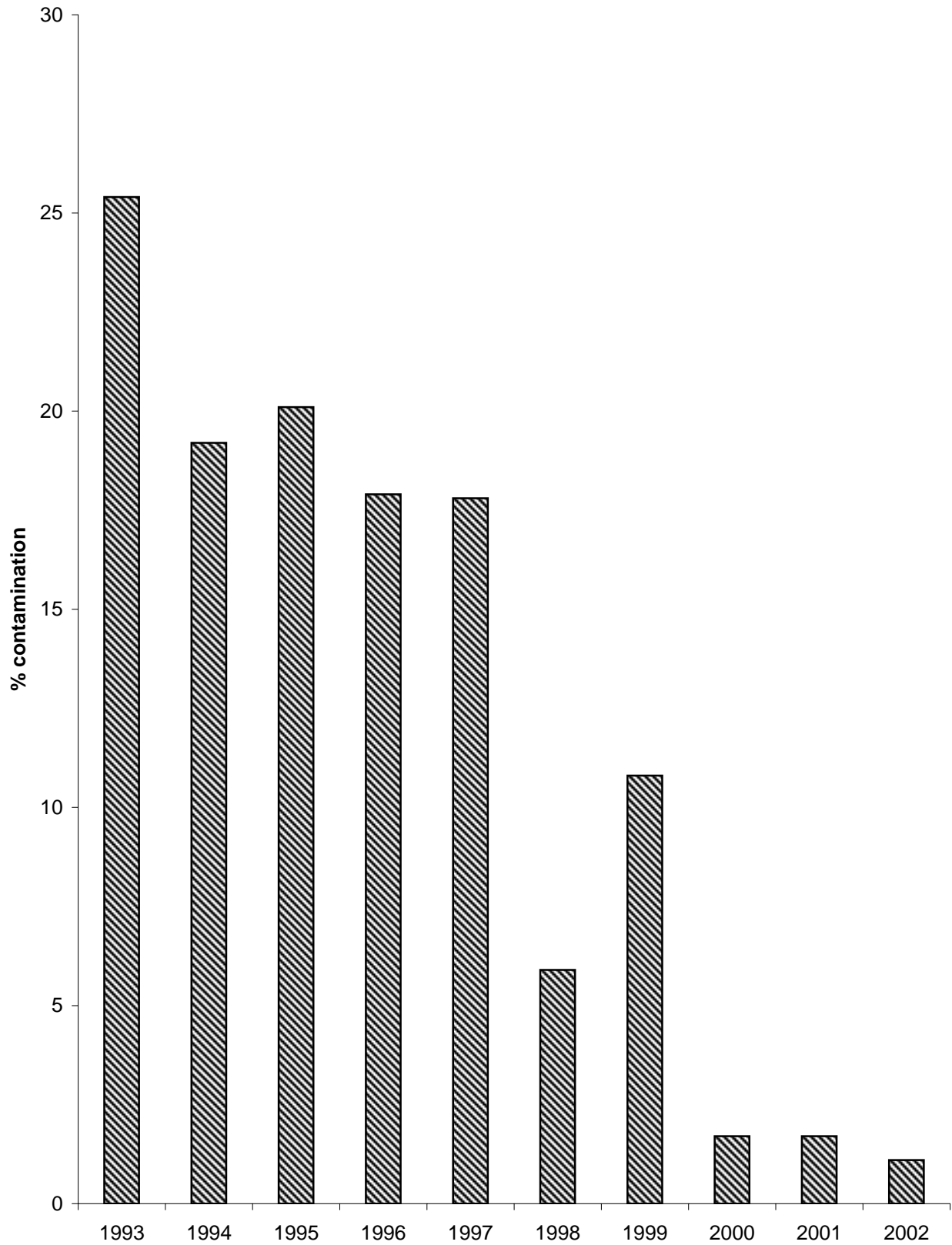


Table 79: Animal By-Products Order 1999 - serotypes isolated during 2002 from official and private testing of domestic protein, compared with previous year

<i>Salmonella</i> serotype	Isolations 2001	<i>Salmonella</i> serotype	Isolations 2002
Group D	1	Kedougou	1
Total isolations	1	Total isolations	1
No. of positive batches	1	No. of positive batches	1

Table 80: The Importation of Processed Animal Protein Order, 1981 - imported protein contamination rates in 2002, compared with the previous year

Sample Type	Batches Tested in 2001			Batches Tested in 2002		
	No	+ve	% +ve	No	+ve	% +ve
Meat & Bone Meal	13	2	15.4	19	5	26.3
Greaves	2	1	50.0	4	1	25.0
Fish Meal	115	18	15.7	118	18	15.3
Others	4	0	-	6	0	-
Total	134	21	15.7	147	24	16.3

**Fig 44: Contamination rate: imported processed animal protein
(batches tested) 1993 - 2002**

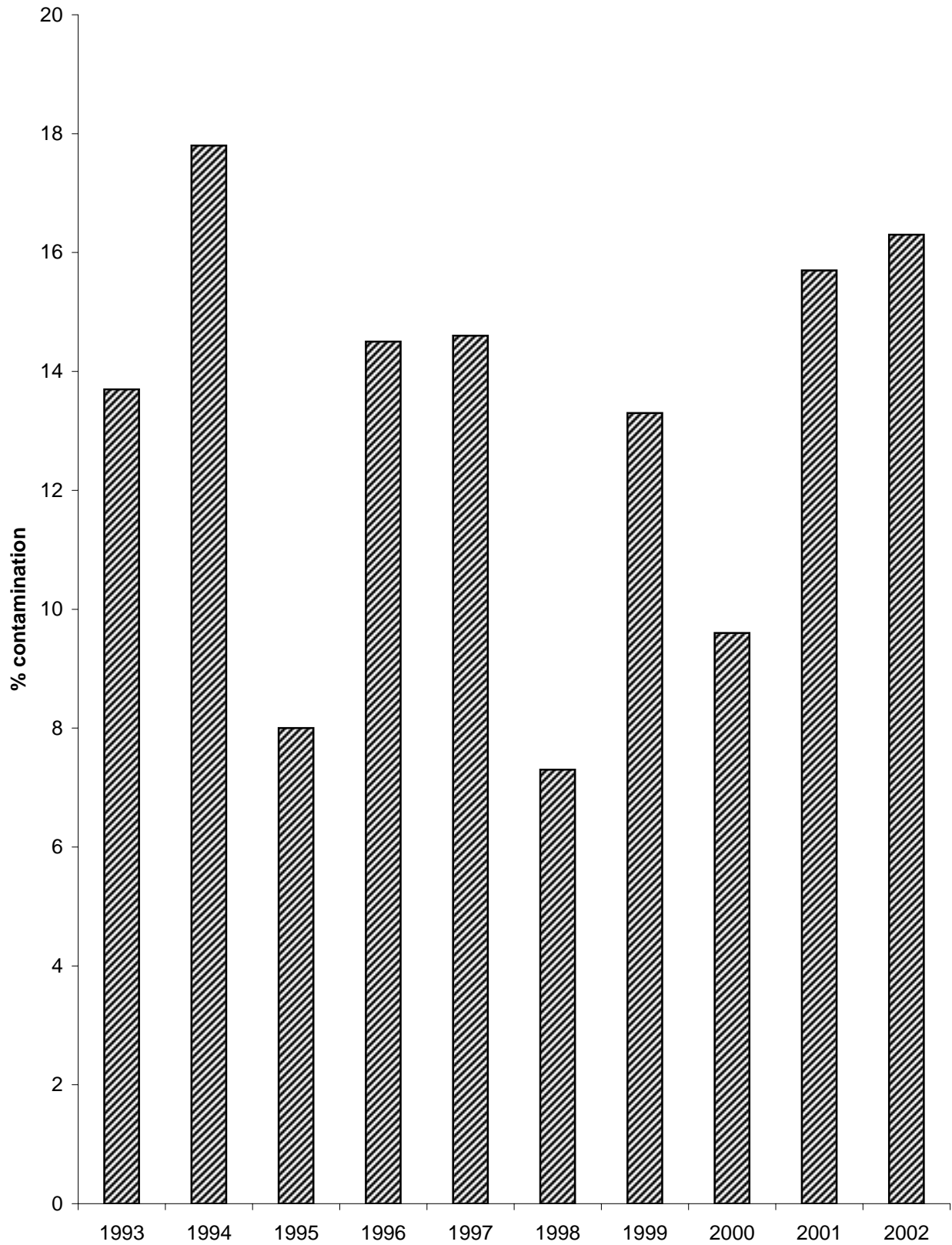


Table 81: The Importation of Processed Animal Protein Order, 1981 - serotypes isolated during 2002 from imported protein, compared with the previous year

<i>Salmonella</i> serotype	Isolations 2001	<i>Salmonella</i> serotype	Isolations 2002
Anatum	6	Montevideo	3
Ohio	4	Anatum	2
Tennessee	3	Havana	2
Binza	1	Poona	2
Cerro	1	Senftenberg	2
Falkensee	1	Enteritidis	1
Infantis	1	Kedougou	1
Isangi	1	Livingstone	1
Kisii	1	Newington	1
Lille	1	Ohio	1
Mbandaka	1	Tennessee	1
Montevideo	1	Typhimurium	1
Thomasville	1	6,7:-:-	1
Group B	2	Group E	3
Group C	2	Group C	2
		Group B	1
		Group G	1
Untyped	1		
Total isolations	28	Total isolations	26
No. of positive batches	21	No. of positive batches	24