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## **SALMONELLAE IN ANIMAL FEED STUFFS** (With 2 Tables)

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### **السالمونيلا في العلائق الحيوانية**

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تم في هذه الدراسة إجراء الفحوص البكتريولوجية على ٨٢٠ عينة من العلائق الحيوانية (٥٢٣ عينة مركزات أعلاف ، ٢٤٢ عينة مسحوق لحم وعظم ، ٥٠ عينة أعلاف كاملة و ٥ عينات مسحوق دواجن) عزل ميكروب السالمونيلا من ١٦ عينة بنسبة ٩٥ ، ١٪. وجد أن نسبة عزل السالمونيلا في العلائق الحيوانية تختلف على حسب نوع العليقة ففي مسحوق الدواجن تم عزل عترة واحدة من السالمونيلا بنسبة ٢٠٪ وفي الأعلاف الكاملة تم عزل عدد ٢ عترة من السالمونيلا بنسبة ٤٪. أما في مسحوق اللحم والعظم فقد تم عزل عدد ٩ عترات من السالمونيلا بنسبة ٧٢ ، ٣٪ وأخيراً في مركزات الأعلاف تم عزل عدد ٤ عترات من السالمونيلا بنسبة ٧٦٪. وبالفحص السيرولوجي للعترات المعزولة (١٦ عترة) من العلائق الحيوانية وجد أنها تنتمي إلى ٩ أنواع سيرولوجية مختلفة: سالمونيلا مونستر (٤ عترات)، سالمونيلا سيرو (٣ عترات)، سالمونيلا تيفيميوريم وسالمونيلا أناتم (٢ عترة لكل منهما)، وعترة واحدة لكل من سالمونيلا كينجستون، سالمونيلا ريببوس ، سالمونيلا ستوكهولم ، سالمونيلا بينزا وسالمونيلا بوكر. وتم مناقشة النتائج وأهميتها.

### **SUMMARY**

In this study *Salmonella* species were detected in 16 out of 820 samples of animal feeds composed of 523 feed concentrate, 242 meat and bone meal, 50 complete feed and 5 poultry meal. The rate of *Salmonella* contamination varied according to the nature of the sample, one (20%) of the poultry meal, 2(4%) of the complete feed, 9(3.72%) of the meat and bone meal and 4 (0.76%) of the feed concentrate. The 16 *Salmonella* isolates represented 9 serovars; *S.muenster* (4 isolates), *S.cerro* (3 isolates), *S.typhimurium* and *S.anatum* (2 isolates each) and one isolate of each of *S.kingston*, *S.reubeuss*, *S.stockholm*, *S.binza* and *S.boecker*

**Key words:** *Salmonella* - Animal's - Feed stuffs..

## INTRODUCTION

Salmonellosis has emerged as a veterinary and public health problem of major importance. Its occurrence is worldwide and appears to be increasing in most countries (Hacking *et al.*, 1978; Nabbut *et al.*, 1982 and Veldman *et al.*, 1995).

Animal feed constitute one of the major inanimate sources of various *Salmonella* serovars. These serovars have a path of infection from animals and ultimately to human beings (Bains and Mackenzie, 1974).

William (1975) and Wray and Sojka (1977) suggested that the increase of bovine salmonellosis epidemics caused by exotic serovars might be due to the increased use of contaminated imported feed. Porneroy *et al.* (1984) had proved the successful introduction of *Salmonellae* into breeding flocks by contaminated feed.

The most important factor in the overall control of *Salmonellae* in poultry is to ensure the supply of *Salmonella*-free feed and water especially in breeding stock (Williams, 1978).

A trial was made to study the incidence of *Salmonellae* in animal feed and feed ingredients, in order to reassess the role of animal feed stuffs as a source of *Salmonella* species in animals and poultry.

## MATERIAL and METHODS

### Samples:

Between January, 1995 and December, 1996, a total of 820 representative samples of feed components and animal feeds were examined. The numbers of samples of feed components taken were; feed concentrate (523), meat and bone meal (242), complete feed (50) and poultry meal (5).

### Isolation of *Salmonellae*:

According to the International Commission on Microbiological Specification for Food (Anon, 1978), a representative fresh sample composed of 25 grams was mixed into 225 buffered peptone water "pH 7" as pre-enrichment and incubated at 37°C for 24 hours. 10 ml of this broth were then added to 100 ml selenite-F broth (Difco) as a selective enrichment and incubated at 37°C for 16-18 hours. A loopful of the latter was streaked on *Salmonella-Shigella* agar and MacConkey agar (Oxoid) plates. The plates were incubated at 37°C for 24 hours and examined for the presence of *Salmonella* suspected colonies.

### **Identification of *Salmonellae*:**

Two or more colonies with characteristics similar to those of *Salmonella* colonies were picked from each selective plate and were subcultured onto nutrient agar (Oxoid) slopes and incubated at 37°C for 24 hours for further identification.

The isolates were identified microscopically, culturally and biochemically according to Krieg and Holt (1984). The following biochemical tests were used: reaction on triple sugar iron agar, lysine decarboxylase, urease, methyl red, indol, citrate and malonate utilization, and fermentation of glucose, lactose, sucrose, mannitol and salicin. All the tests were done using media from Difco Laboratories, Detroit, Michigan, USA.

### **Serotyping of *Salmonellae*:**

Serological identification of suspected *Salmonella* strains was carried out according to Kauffman-White scheme as described by Edwards and Ewing (1972) and Kauffman (1973). Serotyping of the isolates was performed with slide-agglutination tests using *Salmonella* polyvalent and monovalent "O" and "H" antisera obtained from Wellcome Diagnostics, Dartford, England.

## **RESULTS**

Of 820 samples of animal feed, 16(1.95%) were positive for *Salmonellae* (Table 1). From the table, the poultry meal samples showed the highest salmonella contamination rate (20%), while complete feed, meat and bone meal and feed concentrate proved to be harbouring salmonella with an incidence of 4%, 3.72% and 0.76% respectively.

The serotyping of recovered salmonella isolates belonged to nine serovars (Table 2). From this table the most prevalent one was *S.muenster* (4 isolates), followed by *S.cerro* (3 isolates). Moreover, 2 serovars were identified as *S.typhimurium* and *S.anatum* (2 isolates of each). On the other hand, one isolate belonged to each of *S.kingston*, *S.reubeuss*, *S.stockholm*, *S.binza* and *S.boecker*.

The distribution of the 16 *Salmonella* serovars recovered from animal feeds is shown in table 2. From the table, it is revealed that *S.typhimurium* and *S.muenster* were recovered from feed concentrate, each with an incidence of 12.50% as compared to the total isolates. Three strains of *S.cerro* (18.75%), 2 strains of each of *S.muenster* and *S.anatum* (12.50% each) and one of either *S.stockholm* or *S.boecker* (6.25% each) was isolated from meat and bone meal. One strain of either *S.kingston* or *S.reubeuss* was isolated from complete feed, each with an incidence of 6.25%. Moreover,

one isolate of *S. binza* (6.25%) was isolated, from poultry meal. Members of group E<sub>1</sub> constituted 43.75% of the total isolates groups B and K represented 18.75% each while groups C<sub>2</sub>, E<sub>2</sub> and H represented 6.25% each.

## DISCUSSION

Food animals which are reared intensively remain a major source of *Salmonella* in various countries (Hacking *et al.*, 1978; Yoshimura *et al.*, 1979; Nabbut *et al.*, 1982 and Veldman *et al.*, 1995). The overall contamination rate of 1.95% of the feed samples examined during the present study was lower than the 4.5% reported by Al-Hindawi and Taha (1979) in Iraq, the 2.5% reported by Kaloyanov *et al.* (1987) in Bulgaria and the 2.63% reported by Mohamed (1993) in Egypt. The variations in the contamination rate of *Salmonella* in animal feed as reported by several authors may be related to the context of sampling procedure, sensitivity of the analytical method, types and source of feed components, the techniques used in feed factories and the epidemiology of *Salmonella* under the prevailing socioeconomic conditions. This assumption conforms with that reported by Veldman *et al.* (1995).

Despite poultry meal samples had the highest contamination rate 20% of the 5 samples examined, it is unwise to depend on this percentage under condition of this study since it needs further investigations on large number of samples. Complete feed and mixed meat and bone meal showed an incidence of 4% and 3.72% respectively, while feed concentrate had the lowest one (0.76%). These results are nearly similar to the findings obtained by many investigators. Mohamed (1993) recovered *Salmonellae* in local feed concentrates with an incidence of 1%. Durand *et al.* (1990) isolated *Salmonella* from feed farm samples with an incidence of 5.81%. Veldman *et al.* (1995) found that layers and breeders feeds that mostly not pelleted and mixed meat and bone meal were contaminated with *Salmonellae* with a percentage of 21% and 4% respectively.

In this study, the sixteen *Salmonella* isolates belonged to nine serovars. Group E<sub>1</sub> was the most common somatic group (43.75%) of the total. Velho (1959) found that the most isolates of *Salmonellae* from fish meal belonged to group E in Angola, while Nabbut *et al.* (1982) found that most somatic group was C<sub>1</sub> from animal feeds in Saudi Arabia.

The most prevalent isolate in this study was *S. muenster* 4(25%), followed by *S. cerro* 3 (18.75%), *S. typhimurium* and *S. anatum* 2(12.50%)

each) and one isolate (6.25%) each of *S.kingston*, *S.reubeuss*, *S.stockholm*, *S.binza* and *S.boecker*. Some authors recorded *S.muenster* from various feed stuffs (Pohl *et al.*, 1983; Mrden *et al.*, 1990 and Kramer, 1993). On the other hand, Williams and Benson (1978) and Sultan (1992) noticed that *S.typhimurium* was the most predominant serovar recovered from animal feed. No clear link could be established between the serovars found in the feeds and the feed components (Veldman *et al.*, 1995).

Pathogenesis of Salmonellae is a multifactorial phenomenon and varies with the serovars, dose, and the age and immune status of the host (Turnbull, 1979). *S.typhimurium* strains vary greatly in their virulence for the chicken, large plasmids (>60 megadalton) play an important role in the pathogenesis (Barrow and Lovell, 1989). Other serovars invade the intestinal mucosa and frequent cause severe illness and septicaemia (Copper, 1994).

Contaminated feed with Salmonellae are considered to be possible sources of salmonellosis in farm animals. Salmonellosis is a very important disease not only from the economic point of view but also from the public health aspect as it is zoonotic disease and a cause of food poisoning. The control of contamination of animal feed with Salmonellae depends mainly on the selection of Salmonella-free raw materials from reputable sources and on an effective heat treatment of the feed ingredients.

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Table ( 1 ) : Prevalence of *Salmonellae* in animal feed stuffs .

Type of feed	No. of samples	<i>Salmonella</i> positive	
		Number	Percentage
Feed concentrate	523	4	0.76
Meat and bone meal	242	9	3.72
Complete feed	50	2	4.00
Poultry meal	5	1	20.00
<b>Total</b>	<b>820</b>	<b>16</b>	<b>1.95</b>

Table ( 2 ) : *Salmonella* serovars recovered from animal feed stuffs .

Serovar	Feed concentrate	Meat and bone meal	Complete feed	Poultry meal	Total	
					No.	%
<b>Group B</b>						
<i>S. typhimurium</i>	2	-	-	-	2	12.50
<i>S. kingston</i>	-	-	1	-	1	6.25
<b>Group C<sub>2</sub></b>						
<i>S. reubeuss</i>	-	-	1	-	1	6.25
<b>Group E<sub>1</sub></b>						
<i>S. muenster</i>	2	2	-	-	4	25.00
<i>S. anatum</i>	-	2	-	-	2	12.50
<i>S. stockholm</i>	-	1	-	-	1	6.25
<b>Group E<sub>2</sub></b>						
<i>S. binza</i>	-	-	-	1	1	6.25
<b>Group H</b>						
<i>S. boecker</i>	-	1	-	-	1	6.25
<b>Group K</b>						
<i>S. cerro</i>	-	3	-	-	3	18.75