THE INCIDENCE OF SALMONELLA IN KANSAS FEEDLOTS

by

KEITH A. HAND

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Approved by:

Harry D Anthony
Major Professor

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INTRODUCTION

Salmonellosis is an important, worldwide disease of man and involves all species of wild and domestic animals. There is no way to measure accurately the total cost of salmonellosis to the American economy. In man, some estimates are 2,000,000 human cases annually at a cost of at least $300,000,000 per year. In animals, the monetary effect is somewhat more difficult to estimate. Salmonellae occur in all species and the occurrence of salmonellosis in cattle has increased during the past decade due largely to failure to recognize the disease. In recent years, numerous studies have been conducted on salmonellosis in young calves. There have been but few published articles related to this disease in older animals. The disease is considered to be sporadic in mature animals but may be of significant economical importance in isolated outbreaks.

Feed and water sources have been incriminated in tracing the causatives in reference to salmonellosis outbreaks in cattle. Some studies reveal the possibility of these outbreaks being related to stress factors.

These experiments were carried out to compare the occurrence of Salmonella isolations from cattle suffering stress factors and also under normal conditions to determine the effect of contamination from feed and water sources and other environmental factors.

THE INCIDENCE OF SALMONELLA IN KANSAS FEEDLOTS

Salmonellosis occurs in most countries, and in all species, and its occurrence in cattle has increased during the past decade,[2,19] due in part to its wider dissemination, but due largely to failure to recognize the disease.[7,24,26] In recent years, numerous studies have been conducted on salmonellosis in young calves.[11,15,16,23-25] There have been but few published articles related to this disease in older animals.[13,20,21,29] Salmonellosis is considered to be sporadic in older animals but may be of significant economical importance in isolated outbreaks. Many of the outbreaks which have occurred have been related to stress factors.[27] Some reports incriminate contaminated feed[13,29] and water sources.[18,20]

Many cattle rations do not contain meat scraps or rendered animal by-products. These rations are mostly cereal grains that are infrequent sources of Salmonella.[5] Plant proteins have been found to be contaminated with Salmonella.[1,22] Bone meal, which is sometimes found in cattle feeds may also be contaminated.[14,29]

The occurrence of diarrhea in feedlot cattle ranks along with respiratory diseases and footrot in causing major problems for feedlot operators. In order to have a better understanding of salmonellosis in feedlot cattle, this study was carried out to compare animals recently subjected to stress factors to animals on feed more than 30 days under normal feedlot conditions. The study was also concerned with the presence of contaminated feed, water and other environmental factors.

MATERIALS AND METHODS

Thirty-eight cattle feedlots were selected at random from a total of 151 licensed feedlots in the state of Kansas. The size of individual lots selected ranged from 900 to 25,000 cattle.

Samples collected from each selected feedlot were collected as described below: 50 freshly voided fecal samples directly from the feedlot ground, ten feed samples directly from feed bunks, ten random soil samples from the pens where the fresh fecal samples were collected, and one water sample from the watering devices in the individual pens. All samples, where size of the feedlot permitted, were collected from at least five pens in the feedlot. In feedlots with less than five pens, samples were collected from each pen and at a rate to sample a total of 50 freshly voided fecal samples from the feedlot.

The fresh fecal samples were not collected specifically at random but the ten-gram samples[9] were collected carefully from the ground in a manner to insure that contamination from the soil or bedding did not occur. Attempts were made to sample fecal materials from any animal in a pen that was clinically demonstrating symptoms of diarrhea.

The soil samples were taken from the same pens where the fresh fecal samples were collected. Soil samples were collected from ten different locations in each of five pens. The locations were along a hypothetical "X" in the pen with five samples collected along one diagonal line and four samples on the other line. The tenth location sampled was the middle of an area at the back of the pen. A six gram sample (approximate) was taken from each location sampled and composited

to make two 30 gram samples. Soil samples were collected in the same manner in the sick pens.

The feed samples were taken directly from the feed bunks. Many of these feed samples contained a high percentage of roughage. These samples were collected at ten equally spaced intervals along the feed bunks in each of the five pens and composited as were the soil samples.

The water samples were collected from the waterers in each of five pens. These were 30-ml. samples of water and no attempts were made to filter the samples prior to collection.

All fecal samples were processed as individual samples. The soil and feed samples were composited from material collected from five different locations in order to lessen the laboratory work load.

In feedlots where the size of the feedlot permitted, pens were selected according to the period of time the cattle had been fed. Pens of cattle sampled were arbitrarily placed in the following groups: cattle on feed one to 15 days, 16 to 45 days, 46 to 75 days, 76 to 105 days and 106 plus days. The cattle were sampled in this manner to determine if there would be greater or lesser isolations made from cattle that had been recently stressed when compared to cattle on feed for an extended period of time.

All samples were collected in sterile plastic containers* and were transported under refrigeration to the laboratory at Kansas State University were processing was initiated within 24 hours following collection.

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*(4020) Falcon Plastics, Los Angeles, California.

One hundred mls. of tetrathionate-brilliant green broth* was added to each specimen and the samples were incubated for 24 hours at 37° C. Following incubation the samples were streaked on brilliant green sulfadizine agar* and again incubated for 24 hours, at 37° C. The agar plates were carefully streaked in such a manner that isolated colonies could be obtained.

Typical Salmonella colonies (transparent pink to deep fuchsia) were selected to inoculate triple sugar iron, lysine iron, Simmon's citrate, urea and nutrient agar tubes. The triple sugar iron and lysine iron tubes were inoculated by stabbing the butt, and streaking the slant. The remaining tubes were streaked on the slant. A minimum of three colonies from each agar plate were selected for biochemical tests. All tubes were incubated at 37° C. for 18 to 24 hours.

Cultures that produced typical biochemical reactions for Salmonella were screened with Salmonella polyvalent "O" antiserum,* as stated in ARS. 91-68-1.[4] Those with agglutination were then subjected to the individual "O" antiserum.* These cultures were also checked for "H" antigens using the Spicer-Edwards Technique.[12]

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*Difco, Detroit, Michigan.

RESULTS

Thirty-eight feedlots were sampled during the time period July 26, 1971 to March 8, 1972. Two thousand, seven hundred and forty-seven samples were collected and processed from the 38 feedlots. Of this total, 371 were soil samples from the individual pens. The soil samples averaged approximately one-half soil and the remainder was dried fecal material, bedding or hay. Three soil samples were positive for *Salmonella*. Two of these soil samples were collected from individual pens in feedlots where seven of ten animals sampled were positive for *Salmonella*. The remaining soil isolation was collected from a pen where one of ten animals sampled was positive. In this pen, the isolates from the soil belonged to the "E" group of the "O" antigens, and the isolate from the animal belonged to the "C_2" group. The isolation rate from the soil samples of all feedlots sampled was 0.81%.

Freshly voided fecal samples were collected from 35 of the 38 feedlots sampled. Three of the lots did not contain cattle at the time of sampling and an additional feedlot was being used as a "gathering" facility and had only 25 head of cattle at the time of sampling. A total of 1,719 fecal samples were collected and processed. *Salmonella* was isolated from 19 of these samples. The 19 positive samples were collected from a total of nine different feedlots. Seven of the positive samples were collected from a single pen in one feedlot and represent the highest percentage of positive samples collected for any given lot of samples. The seven positive samples yielded *Salmonella* belonging to the "C" and "B" antigen groups. Two fecal samples were

positive in two other feedlots. In each case, only one individual pen was involved and in one pen both isolates belonged to the "C_2" group. In the other feedlot, isolates were of the "B" and "E" groups. Single isolates were made from five additional feedlots. The isolation rate from freshly voided fecal samples was 1.10%.

A total of 159 samples were collected from the sick pens in 36 of the feedlots sampled. Two of the feedlots did not have a specific area to hold or treat sick animals. These samples consisted of dried fecal material, bedding, and soil. Isolations of Salmonella were made from sick pen soil samples in five feedlots. In two of these feedlots, the soil samples from the sick pens were the only isolations made. The other three feedlots also had positive fecal samples and one of these had an isolation from a soil sample collected from an individual pen. The isolation rate from the sick pen soil samples was 4.40%.

Feed samples were collected from the feed bunks in individual pens at 35 of the feedlots sampled. A total of 339 feed samples were collected and processed. Of this total, 337 were beef cattle rations and all were negative for Salmonella. Two feed samples were collected from one feedlot that runs hogs behind calves in the feedlot. The two samples were collected from a metal hog feeder and appeared to have a high percentage of meat and bone meal in the ration. Both samples were positive for Salmonella and were the only isolations made from this particular feedlot. From the feedlot containing the contaminated hog feed, 50 soil samples were collected from the individual pens; 50 freshly voided fecal samples, ten feed samples (beef ration) were collected from

the feed bunks and five water samples were collected from the watering tanks; all were negative for Salmonella by cultural techniques.

A total of 159 water samples were collected from 35 different feedlots. Water samples were collected from watering tanks or containers in individual pens. Salmonella organisms were isolated from one of the 159 samples (0.63%). The isolation from the water was taken from a pen where seven of the ten calves sampled were positive for Salmonella. The two soil samples were also positive in this pen. This particular feedlot was using water filtered but not chlorinated from a river. The feedlot was sampled a second time 124 days following the initial sampling. Twenty fecal samples were collected from the pen of cattle with Salmonella isolations on the initial investigation. These samples, as well as samples collected from the feed bunks and the soil, were all negative on the second collection.

Nine of the feedlots had a number of calves which had been on feed for different time intervals. These feedlots provide an opportunity for comparing differences in isolations as to the length of time the calves were on feed. A total of 90 calves on feed for 15 days or less were sampled. Salmonella was isolated from 11 of these calves. The 11 positive specimens were collected from four of the nine feedlots. Two isolations were made from 90 specimens collected in the 16 to 45 day interval from one additional feedlot. Isolation attempts were negative for Salmonella from cattle on feed 45 days or longer.

DISCUSSION

The results reported here generally correlate with results of other workers in this country. Salmonella was isolated from the intestinal tract of 0.4% of the cattle slaughtered as shown by a survey conducted by Consumer and Marketing Services in 1968. A number of studies have shown a much higher isolation rate in foreign countries.[10,16] This may be due in part to the presence of Salmonella dublin which may develop a carrier state with more frequency than do the other serotypes of Salmonella.[8,24,28]

Salmonellosis in feedlot age calves is thought to be fairly rare unless these animals are stressed in some manner.[20] The results from nine of the feedlots surveyed, where calves were sampled according to the number of days they had been on feed, showed more isolations were obtained from animals that had just recently been added to the feedlots. The stress of movement, weaning, mixing with calves from other sources and change of diet could account for this increased isolation rate.[3]

Most of the feedlots sampled were lots in which sick animals were usually removed from their original pens and taken to a sick pen or hospital area for ease of handling while being treated. These stressed animals, in many cases, were being placed in an environment contaminated with Salmonella. Most of the feedlots had limited facilities to castrate, dehorn and vaccinate incoming animals and a majority of the feedlots use the cattle chutes in the sick pen areas and may use the sick pens for holding pens. This, again, places stressed animals in an area that could be contaminated with a number of pathogens including Salmonella.

The negative results obtained on feed samples is contrary to many published reports on animal feeds.[1,6] The rations sampled in this survey contained less than two percent of the protein as animal protein. Due to palatability, very little animal protein is used in beef rations. The feed was sampled at the feed bunk and was a mixture of ensilage or hay and concentrates. Most of the protein was of plant origin.

The addition of ensilage or hay to the ration could have easily diluted the grain and protein mix to a level where the methods for isolation of Salmonella were unable to detect very low concentrations of the organism.[4,5]

One of the feedlots was using a river as a source of water. An isolation was made from the watering container in the pen where Salmonella was isolated from seven of ten animals sampled. A contaminated watering container could be a source for the spread of infection within a given pen of cattle.

One of the feedlots commonly runs swine behind the cattle in the feedlot. The hogs are provided supplement which is high in animal protein. The supplement was contaminated with Salmonella at the time of sample collection. This could easily be a source of infection at a future date for this feedlot. However, at the time of sampling, the two swine ration samples were the only samples where isolations of Salmonella were made.

SUMMARY

A total of 2,747 samples were collected and processed from 38 feedlots. The isolation rate was 1.16%. Twelve of 38 of the feedlots tested yielded isolations of Salmonella.

One feedlot had seven positive fecal samples from a total of ten samples collected from one pen. This feedlot was sampled for the second time four months later and no additional isolations were made. The manager of the lot reported that there was a severe diarrhea problem in two different pens of calves a few days after the initial sampling.

A total of five lots had positive isolations from the sick pen soil samples. This suggests that these lots possibly had a problem with salmonellosis in the past.

TABLES

TABLE I. SALMONELLA SPECIES ISOLATES FROM FECAL SAMPLES OBTAINED FROM NINE FEEDLOTS HAVING CATTLE ON FEED FOR VARYING TIME INTERVALS.

Feedlot No.	Number of Days on Feed				
	1-15	16-45	46-75	76-105	106 +
1	10/0*	10/2	10/0	10/0	10/0
2	10/0	10/0	10/0	10/0	10/0
9	10/0	10/0	10/0	10/0	10/0
13	10/7	10/0	10/0	10/0	10/0
22	10/0	10/0	10/0	10/0	10/0
26	10/2	10/0	10/0	10/0	10/0
44	10/1	10/0	10/0	10/0	10/0
46	10/1	10/0	10/0	10/0	10/0
51	10/0	10/0	10/0	10/0	10/0

*Total calves sampled/number positive isolations.

TABLE II. FEEDLOTS HAVING SALMONELLA POSITIVE FECAL SAMPLES SHOWING NUMBERS POSITIVE AND DAYS ON FEED

Feedlot No.	No. of Positive Animals	Actual Days on Feed
1	2	35
13	7	8
26	2	6
44	1	8
46	1	1

TABLE III. TOTAL SAMPLES COLLECTED FROM 38 KANSAS FEEDLOTS AND THE NUMBER POSITIVE FOR THE ISOLATION OF SALMONELLA

Type of Sample	Total Samples	No. Positive	Percent Positive
Soil Samples	371	3	0.81%
Fecal Samples	1719	19	1.10%
Sick Pen Soil Samples	159	7	4.40%
Feed (Beef)	337	0	0.0%
H_2O	159	1	0.63%
Rat Feces	1	0	0.0%
Hog Ration	2	2	100%
Flies	1	0	0.0%

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APPENDIX

REVIEW OF LITERATURE

Even though the Salmonella organism has been recognized for more than 150 years, most of the work in this field has been fairly restricted to the disease syndrome in humans and poultry until the last few decades. Today salmonellosis is recognized as one of the most important diseases in affecting livestock. It has been estimated that from one to three percent of all domestic animals are infected with Salmonellae.[5]

Surveys appear in the literature regarding a high isolation rate from cattle at the time of slaughter. Daleel[6] reported the results from sampling 2,000 cattle at two Brisbane Abattoirs. A total of 11.6% of the cattle were infected with 32 serotypes. Salmonella isolations were from 18% of 300 rumen samples, 10.1% of 1,188 fecal samples, 9% of 100 samples from the large intestine and from 7.8% of 671 samples from the small intestine.

Grau[12] sampled animals slaughtered at five Abattoirs in Southeastern Queensland. Eighty-seven (45%) of 193 samples of rumen fluid were found to contain Salmonella.

A New Zealand survey reported by Nottingham[18] showed a 13 to 15% infection rate in dairy cows and calves. Beef cattle in the survey had an infection rate of four percent.

In 1968, a survey by Consumer and Marketing Service, U. S. Department of Agriculture, showed the following percent of livestock and poultry to be carrying Salmonella in their intestinal tract at the time of slaughter: cattle 0.4%, swine 10.7%, chickens 3.8%, turkeys 5.8%, sheep 0.07% and horses 14.9%.

Data from Abattoir material must be accepted with caution because of the known increase in the Salmonella population of the gut in animals kept in holding pens for several days.[13] De Jong[7] suggested that the incidence of Salmonella in slaughtered animals might be due to extensive cross-infection during transit and in holding pens before slaughter. In an investigation made by Anderson,[2] the mean infection rate in calves on the farm was estimated at 0.5%; it increased to nearly 36% after the animals were kept in holding pens for two to five days.

Studies considering mortality and morbidity for calves with salmonellosis are fairly numerous. Rothenbacker[20] reported that on 39 Michigan farms during a 20-month period, 297 calves died from salmonellosis. Reports from 26 farms indicated a mortality of 23.6% (155 calves of a total of 663). For nine of these farms, there was 19.0% mortality and 21.7% morbidity of a total of 226 calves.

Gibson[11] reported that epidemiologically there were two main forms of salmonellosis in Britain. One form occurred in areas where Salmonella dublin was endemic in adult and yearling cattle. The other form which typically occurs among large batches of purchased calves tended to take a severe course, with high mortality, and sometimes affects successive batches of calves.

Endres[10] reported that the average rate of isolation from calves sampled on a feeder calf producing ranch ranged from 11.5% to a high of 18.5%. This study divided one group of calves at entry to the premises, with one-half of the animals placed in two community pens with cafeteria feeders and the other one-half placed in individual pens with bottle feeders. Higher isolation rates were obtained from the community pens.

This group also had a higher death rate (17%, nearly two times the rate for any other group).

In recent years, enteritis in dairy and beef cattle caused by Salmonella has increased, according to Edwards[9] and Moran.[16] Aserkoff[4] reports that non-human sources of Salmonella have increased during a five-year period from 5,389 in 1963 to 8,794 in 1967.

Salmonella typhimurium was the most common serotype isolated from non-human sources,[4] accounting for 17.3% of all isolations. S. heidelberg, S. infantis, S. saint-paul, S. derby and S. newport were also most commonly isolated and these serotypes were also among the top ten serotypes isolated from humans.

Dennis[8] reported that S. typhimurium was the serotype isolated from 12 of 13 typed outbreaks in cattle in Western Australia. Since 1950, S. typhimurium has been the most common serotype isolated, and was recovered from all the domestic animals included in his report.

Gibson[11] and Stevens[22] reported that the chief causes of salmonellosis in calves are Salmonella dublin and S. typhimurium. Stevens also reported that S. dublin occurred almost exclusively in cattle and infections in cattle were more likely to have originated from other infected cattle rather than from other species of domestic livestock. In contrast to this, S. typhimurium was one of the most widespread of all bacterial pathogens, and could infect and be carried by most species, including man and many forms of wild life.

Schnurrenberger[21] attempted to isolate Salmonella from 976 domestic mammals, 325 wild birds, 253 wild mammals and 217 feed samples from

seven farms in Illinois. A total of 26 isolations were made and there was little evidence of interspecific transmission of salmonellosis.

Rankin[19] reported in 1966 that the incidence of Salmonella typhimurium infections has more than doubled within the last two years. This indicates a very definite alteration in the pattern of bovine salmonellosis in Britain, where for many years S. dublin has been the common Salmonella of cattle. He also stated that this change may or may not be due to the changing methods of calf management. Isolations of S. newport from cattle with salmonellosis have been reported recently. Moore[15] isolated S. newport as the most common serotype (80%) from fatal cases of enteritis in cattle. The author suggested that the serotype may cause serious losses in stressed cattle.

Articles have appeared in the literature recently that incriminate the source of infection for salmonellosis as contaminated feed. Van Dreumel[23] reported on an epizootic of salmonellosis in 24 beef herds which resulted from the ingestion of contaminated bone meal. Studies have shown that Salmonella organisms are frequent contaminants of animal protein used for livestock feeds.[1,17,24] High contamination rates, 40% in 1969 and 52% for 1970, have occurred in the finished-product samples collected in Blender plants.[24]

In the report by Allred[1] the contamination rate for grain was found to be 0.66%, fishmeal 4.72%, cattle feed 0.85%, poultry feed 5.23%, oilseed meal 2.28%, animal by-product 31.07%, and swine feed 3.13%.

From a public health standpoint, numerous articles have appeared which put much of the blame for human salmonellosis on the high contam-

ination rate of Salmonella found in poultry and poultry products. Hobbs[14] in a report stated that is was possible to demonstrate from retrospective records that a link existed between contaminated animal feedstuffs, turkeys, and an outbreak of Salmonella senftenburg infection at Ryhope Hospital.

Controls for salmonellosis in domestic animals[5] include: 1) Minimize Salmonella-contaminated feeds (especially poultry and swine), 2) Convert present pullorum and fowl typhoid control programs into eradication programs involving all chickens and turkey breeding flocks, 3) Develop Salmonella-free breeding herds and flocks and protect them against contamination from outside sources, 4) Provide clean water supplies and hold animals in sanitary buildings and pens, 5) Segregate clinically ill animals and withhold them from the market as long as they are excreting Salmonellae, 6) Schedule shipment of animals to permit holding them on the farm as long as possible and at the slaughterhouse for as short a time as possible, 7) Transport animals to market in clean vehicles, and 8) Hold animals at slaughterhouses in clean pens or cages.

The Code of Practice for the control of salmonellosis Article 3 states that in considering the epidemiology of salmonellosis in cattle, protein of animal origin in feeding stuffs is not an important factor and the main method of spread was by the movement and mixing of young calves from a number of different sources.

RESULTS FROM ALL FEEDLOTS SAMPLED

Date Sampled	# Assigned	Fecals	Soil	Feed	Water	S.P.* Soil	TOTAL
7-26-71	5	50/0	10/0	5/0	3/0	5/0	73/0
7-27-71	12	50/0	10/0	10/0	3/0	2/0	75/0
7-27-71	33	50/0	10/0	10/0	3/0	2/0	75/0
7-29-71	3	50/0	10/0	10/0	5/0	10/0	85/0
7-29-71	8	50/0	10/0	10/0	4/0	2/0	76/0
8-10-71	43	50/0	10/0	10/0	3/0	4/0	77/0
8-10-71	34	50/0	10/0	10/0	3/0	7/0	80/0
8-12-71	42	--	10/0	--	--	8/0	18/0
8-12-71	49	--	10/0	--	--	2/0	12/0
8-12-71	19	51/0	10/0	10/0	5/0	2/1	78/1
8-17-71	32	50/0	10/0	10/0	5/0	2/0	77/0
8-17-71	38	50/1	10/0	10/0	5/0	2/0	77/1
8-17-71	14	--	6/0	--	--	1/0	7/0
9-7-71	45	17/1	5/0	2/0	1/0	0/0	25/1
9-15-71	6	50/0	10/0	10/0	5/0	2/0	77/0
9-15-71	28	50/0	10/0	10/0	5/0	7/0	82/0
9-22-71	46	50/1	10/1	10/0	5/0	5/1	80/3
9-22-71	26	50/2	10/0	10/0	5/0	5/1	80/3
10-8-71	13	50/7	10/2	10/0	5/1	3/0	78/10
10-12-71	48	50/0	10/0	10/0	5/0	6/0	81/0
10-12-71	44	50/1	10/0	10/0	5/0	6/2	81/3
10-20-71	47	50/0	10/0	10/0	5/0	2/0	77/0
10-20-71	4	51/1	10/0	10/0	5/0	4/0	80/1

*Sick Pen.

(cont'd)

Date Sampled	# Assigned	Fecals	Soil	Feed	Water	S.P. Soil	TOTAL
11-10-71	24	50/0	10/0	10/0	4/0	4/0	78/0
11-10-71	2	50/3	10/0	10/0	5/0	6/0	81/3
11-15-71	22	50/0	10/0	10/0	5/0	10/0	85/0
11-15-71	16	50/0	10/0	10/0	5/0	2/0	77/0
12-15-71	39	50/0	10/0	12/2*	5/0	0/0	77/2
1-7-72	51	50/0	10/0	10/0	5/0	6/2	81/2
1-7-72	1	50/2	10/0	10/0	5/0	2/0	77/2
1-13-72	31	50/0	10/0	10/0	5/0	8/0	83/0
1-13-72	7	50/0	10/0	10/0	5/0	6/0	81/0
2-9-72	41	50/0	10/0	10/0	5/0	5/0	80/0
2-9-72	17	50/0	10/0	10/0	5/0	4/0	79/0
2-15-72	9	50/0	10/0	10/0	5/0	5/0	80/0
2-15-72	29	50/0	10/0	10/0	5/0	3/0	78/0
3-1-72	15	50/0	10/0	10/0	5/0	5/0	80/0
3-8-72	55	50/0	10/0	10/0	5/0	4/0	79/0
Total		1719/19	371/3	339/2*	159/1	159/7	2747/32
Percent		1.10%	0.81%	0.59%	0.63%	4.40%	1.16%

*Includes two swine ration samples that were positive for Salmonella.

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THE INCIDENCE OF SALMONELLA IN KANSAS FEEDLOTS

by

KEITH A. HAND

D. V. M., Oklahoma State University, 1968

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MASTER OF SCIENCE

Department of Pathology

KANSAS STATE UNIVERSITY
Manhattan, Kansas

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Salmonellosis occurs in most countries and in all species. Its occurrence in cattle has increased, due in part to its wider dissemination, but largely to failure in the past to recognize the disease. Numerous studies have been conducted on salmonellosis in young calves. However, few studies relating to older calves and adult cattle have been carried out. Surveys have been made to determine the incidence of infection at the time of slaughter, but little is actually known about the rate of infection in feedlot age animals while they are in feedlots.

A total of 2,747 samples were collected and processed from 38 licensed commercial feedlots in the state of Kansas. The specimens collected from each feedlot included: 50 freshly voided fecal samples, 10 soil samples from individual pens and 10 feed samples collected from the feed bunks. Soil samples were also collected from the sick pens or hospital areas. Both of the "soil" samples contained a high percentage of dried fecal material and some bedding material. A water sample was also collected from each individual pen where the soil and fecal samples were collected.

Of the total samples collected, 371 were soil samples and three of these were positive for the isolation of Salmonella. Fecal samples amounted to 1,719 of the total collected and 19 (1.10%) were positive. A total of 159 samples were collected from soil in the sick pen areas and seven (4.40%) were positive. No isolations were made from 337 beef ration samples. Salmonella was isolated from one (0.63%) of the water samples. One feedlot sampled had swine running in the same pens with the cattle and two swine ration samples were collected and isolations of Salmonella were made from each swine ration sample.

Nine of the feedlots had a number of calves on feed at different intervals to allow comparisons of isolations as to the length of time the calves were on feed. Individual pens from these feedlots were sampled in groups of: 1) calves on feed less than 15 days, 2) 16-45 days, 3) 46-75 days, 4) 76-105 days, and more than 106 days. Isolations of Salmonella were made from five of these feedlots. Four of the feedlots had isolations from calves on feed 15 days or less and one feedlot had Salmonella isolated from calves on feed for 35 days. No isolations were made from calves on feed in excess of 35 days, with a total of 270 calves on feed in excess of 35 days sampled in these nine feedlots.

The isolation rate from the 38 feedlots sampled was 1.16%. A total of 32 isolations were made from all samples. The 32 positive samples were collected from 12 different feedlots. One feedlot where isolations were made from seven of ten calves sampled that had been on feed for eight days was re-sampled four months later without a single isolation being made. The owner stated that a few days following the initial sampling, two pens of cattle had had a severe diarrhea problem. Five of the feedlots had positive isolations from the sick pen soil samples. This could indicate that these lots had a problem with salmonellosis in the past.