HUMAN ENTERIC PATHOGENS IN DOGS IN CENTRAL ALASKA

Capt C. E. Butler
TSgt B. R. Herd

TECHNICAL DOCUMENTARY REPORT AAL-TDR-64-10

September 1964

ARCTIC AEROMEDICAL LABORATORY
AEROSPACE MEDICAL DIVISION
AIR FORCE SYSTEMS COMMAND
FORT WAINWRIGHT, ALASKA

Project 8241, Task 824101

NOTICES

When US Government drawings, specifications, or other data are used for any purpose other than a definitely related government procurement operation, the government thereby incurs no responsibility nor any obligation whatsoever; and the fact that the government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise, as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

Qualified requesters may obtain copies of this report from the Defense Documentation Center for Scientific and Technical Information (DDC), Cameron Station, Alexandria, Virginia. Orders will be expedited if placed through the librarian or other person designated to request documents from DDC (formerly ASTIA).

Stock quantities are available at Office of Technical Services, Department of Commerce, Washington 25, D. C.

FOREWORD

We wish to thank Mr. Frank Pauls of the Alaska Department of Health and Welfare; the Communicable Disease Center, Atlanta, Georgia; Dr. James C. Beckley, Veterinarian, Fairbanks, and Captain Richard A. Boster, Veterinarian at the Arctic Aeromedical Laboratory, for their assistance during this study.

ABSTRACT

A 12-month's study in Central Alaska shows that family pets are harboring a significant quantity of human intestinal pathogens. While previous investigators in Alaska have found up to 7% of the dogs harboring either Salmonella or Shigella, this study found approximately 18% harboring these plus an additional 9% harboring related, potentially pathogenic organisms. In addition, the study shows that dogs in the area (1) can harbor multiple species of Salmonella at one time, (2) appear to act as transient carriers, and (3) do not necessarily show signs of intestinal infection when the organisms are present. The organisms were found in the animals throughout the year. As a result of the long severe winter, the family pet usually lives in close proximity to human friends; thus it becomes a potential vector of some significance.

PUBLICATION REVIEW

Horace F. Drury

HORACE F. DRURY
Director of Research

[redacted]

HUMAN ENTERIC PATHOGENS IN DOGS IN CENTRAL ALASKA*

SECTION 1. INTRODUCTION

The epidemiology of enteric disease organisms in Alaska is a perplexing problem to Public Health authorities. It has been assumed from past studies that direct person to person contact is the major mode of transmission. However, the mode of living, sparsity of population and predictable annual increase in the incidence rate immediately following the spring leave some doubt that this assumption is entirely correct. Prior studies of enteric disease organisms in Alaska have shown Salmonella and Shigella in dogs (Fournelle, 1956, and Cullison, 1957), gulls (Wilson and Baade, 1959), fur seals (Jellison and Milner, 1958), fresh water fish (Butler, 1963, unpublished) and ground water (Miller and Savage, 1963).

Among these other potential vectors, the dog presents an interesting problem. As the most common domestic animal in Alaska, the dog is sometimes a family pet, sometimes a work animal and often both. In either case, the dog in Alaska usually lives in closer proximity to its human friends than in more moderate climates. Prior investigations of the dog as a reservoir or vector of human enteric pathogens in Alaska have produced divergent results. One survey of 278 dogs resulted in the recovery of a single Shigella species from one animal (Fournelle, 1959); another survey of 54 dogs resulted in a negative recovery (Gordon and Babbott, 1959); while another investigator found Salmonella typhimurium in 7% of the dogs at Point Barrow and in 6% at Fort Yukon (Cullison, 1957). All of these studies were conducted in small villages or towns where water and sewage treatment facilities are essentially nonexistent and gastroenteritis is a frequent problem, particularly in the spring and summer.

Since the dog has been incriminated as a vector or reservoir of human enteric pathogens the world over (Floyd, 1954) and since it represents a major portion of the mammal life in Alaska, this study was conducted to gain more knowledge of the types of organisms present in these animals and to attempt to learn more of its role as a vector. This study was conducted in Fairbanks, the second largest city in Alaska and the most northern urban

* This research was conducted in accordance with the "Principles of Laboratory Animal Care" of the National Society for Medical Research.

area in North America. The city has modern water and sewage treatment facilities but experiences an incidence rate and pattern of gastroenteritis nearly identical to that of any other town or village in the state.

SECTION 2. METHODS

A total of 173 dogs were sampled over a 12-month period. For this study the dogs were divided into two groups: one group consisted of family pets seen either as "outpatients" or temporary "inpatients" at the Fairbanks Veterinary Clinic, while the other group consisted of sled dogs which were kept in kennels during the year. Samples were obtained by inserting a sterile cotton swab 4 to 8 cm into the anus. The sampling distribution is summarized in Table I.

TABLE I

CULTURES OBTAINED

Type of Dog	Number of Dogs Sampled			
	Single Culture	Two Cultures	Three Cultures	Totals
Family Pet	94	2	2	98
Kennel Dog	56	17	2	75
Totals	150	19	4	173

Immediately after obtaining the swab, the cotton tip was moistened with 0.5 ml of 1% peptone water which had been sterilized in the tube with the swab. Within 30 minutes initial inoculation was made onto three agar plates: Salmonella-Shigella (SS), MacConkey's and Eosin Methylene Blue (EMB). After rolling onto the agar plates, the swab was placed in Selenite broth. All incubations were performed at $37^{o} \pm 1^{o}$ C. After 18 hours incubation, a subculture was made from the Selenite broth to a MacConkey's agar plate.

All agar plates were examined after 18 to 24 hours incubation, and suspicious colonies were transferred to 1 ml peptone phosphate broth (PPB). The broth was incubated until cloudy, usually two to four hours. A Kligler's iron agar slant (KIA) and urea agar slant were inoculated from the PPB. Organisms which produced urease in six hours and/or failed to produce suspicious KIA slants in 24 hours were discarded. All suspicious organisms were transferred to a "screening battery" consisting of a motility stab, indol and Carlquist ninhydrin broths, Simmon's citrate and tryptic agar slants (TSA) and glucose, lactose and salicin stabs. Organisms which conformed to either Salmonella or Shigella characteristics (Edwards and Ewing, 1962) were then tested for their capacity to grow in KCN broth. Somatic typing for Salmonella and Shigella were performed from a saline suspension prepared from the TSA slant; Salmonella flagellar typing was performed from H broth. Organisms other than Salmonella orShigella were identified on the basis of biochemical characteristics as listed in Edwards and Ewing (1962). All Salmonella were submitted to Communicable Disease Center, Atlanta, Georgia, for confirmation.

SECTION 3. RESULTS

The results show that the kennel dogs did not exhibit pathogens, while pathogens or potential pathogens were recovered from 27 of the 98 family pets sampled. Table II shows the recovery rate. Potential pathogens include Arizona, Bethesda-Ballerup, Providence, Hafnia and the Alkalescens-Dispar group.

TABLE II

NUMBER AND TYPES OF PATHOGENS RECOVERED

Dog Group	Number of Cultures	Salmonella	Shigella	Potential Pathogens	Totals
Family Pets	98	16	1	10	27
Kennel Dogs	75	0	0	0	0
Totals	173	16	1	10	27

TABLE III

ORGANISMS RECOVERED BY SPECIES OR GROUP

Salmonella	Shigella	Other
champaign	flexneria	Arizona
meleagridis		Bethesda-Ballerup
thomasville		Providence
derby		Hafnia
cubana		Alkalescens-Dispar group
worthington		
lexington		
kentucky		
johannesburg		
cerro		
alachua		
siegburg		
senftenberg		
infantis		
schwarzengrund		
oranienburg		

One unusual result of the study was that in several instances more than one species of Salmonella were recovered from a single swab sample. In two instances three different species of Salmonella were recovered from a single sample. Results are reported in Table IV. Stucker, Galton et al (1952) reported a similar finding from a study on Florida greyhounds in 1951.

TABLE IV

MULTIPLE SPECIES OF SALMONELLA FROM ONE SWAB

Culture Number	Salmonella species recovered		
225	derby	thomasville	
242	worthington	lexington	kentucky
278	siegburg	senftenberg	
280	worthington	schwarzengrund	senftenberg
300	cubana	cerro	
306	oranienburg	cerro	

Repeat cultures were obtained on 4 of the 98 family pets sampled. Two of the dogs were sampled twice, and two were sampled three times. The repeat cultures were not obtained at planned intervals. Table V shows the results of these replicate cultures.

Although it was not planned to compare media, procedures, etc., in this study, it became quite evident that the MacConkey's agar plates streaked from the Selenite broth were giving better recovery results than the three agar plates streaked initially. During future studies it is planned to use mainly enriched broths.

Sampling was conducted in cooperation with two veterinarians, and any signs of intestinal disturbances in the dogs were noted and recorded. Our records show that none of the animals found to be harboring pathogens in this study exhibited signs of intestinal infections. Therefore, we do not refer to these animals as being infected.

TABLE V

RESULTS OF REPEAT CULTURES ON INDIVIDUAL DOGS

Dog	Dates of Cultures	Organisms Recovered
Labrador Retriever	30 Apr. 63	Salmonella infantis
	13 May 63	Salmonella meleagridis
	23 June 63	Shigella flexneria
German Shepherd	1 Apr. 63	No pathogens
	22 Jan. 64	Salmonella alachua
	10 Mar. 64	Salmonella cerro
Poodle	30 Apr. 63	No pathogens
	5 Nov. 63	Salmonella worthington
		Salmonella lexington
		Salmonella kentucky
Cocker Spaniel	1 Apr. 63	Salmonella champaign
	23 June 63	No pathogens

SECTION 4. DISCUSSION

Although results of this study show that dogs in the Central Alaskan area harbor a significant quantity and variety of human intestinal pathogens, their role as vectors is not known. Laboratory identification of the causative agents of human gastroenteritis cases in the area were too exiguous to permit a reasonable epidemiological investigation.

The source of the organisms found in the dogs was not definitely determined. Since the positive animals were not located in one specific locality and a large number of species were recovered, several sources appeared to be involved. Each potential source must be more thoroughly investigated to obtain definitive information. Many of the species recovered have not been reported in Alaska prior to this study.

The fact that pathogens were recovered in significant quantities throughout an entire year indicates that dogs may be a major cold weather reservoir for human intestinal pathogens. Since the family pet and its human friends remain in close physical contact over a long period during the extreme winters, a closer examination of the dog as a vector of human intestinal diseases in Alaska is indicated.

REFERENCES

1. Cullison, J. W. and T.R.A. Davis. The isolation of enteric pathogens at Barrow, Alaska. U.S. Armed Forces Med. J. 8:534-538, 1957.

2. Edwards, P. R. and W. H. Ewing. Identification of Enterobacteriaceae. Minneapolis, Burgess Publishing Co., 1962.

3. Floyd, T. M. Salmonellosis in dog. I. A review of the literature. J. Egypt. Pub. H. Assoc. 29:4-18, 1954.

4. Floyd, T. M. Salmonellosis in dog. II. Survey of Salmonella infection in dogs in Egypt. J. Egypt. Pub. H. Assoc. 29:1-3, 1954.

5. Fournelle, H. J. Experiences with the laboratory diagnosis of enteric disease in Alaska. Amer. J. Med. Techn. 22:36-43, 1956.

6. Fournelle, H. J., V. Rader and C. Allen. Seasonal study of enteric infections in Alaskan Eskimos. Public Health Rep. 74:55-59, 1959.

7. Galton, M. M., J. E. Scatterday and A. V. Hardy. Salmonellosis in dogs. I. Bacteriological, epidemiological and clinical considerations. J. Infect. Dis. 91:1-5, 1952.

8. Gordon, J. E. and F. L. Babbott, Jr. Acute intestinal infection in Alaska. Public Health Rep. 74:49-54, 1959.

9. Jellison, W. L. and K. C. Milner. Salmonellosis of fur seals. J. Wildl. Mgmt. 22:199-200, 1958.

10. Miller, J. and W. Savage, Alaska State Public Health Division of Environmental Health, Fairbanks, Alaska, personal communication, 1963.

11. Pauls, F.P. Enteric diseases in Alaska. Arctic 6:205-215, 1953.

12. Stucker, C. L., M. M. Galton, J. Cowdery and A. V. Hardy. Salmonellosis in dogs. II. Prevalence and distribution in greyhounds in Florida. J. Infect. Dis. 91:6-11, 1952.

13. Williams, R. B. Summary of Salmonella and Shigella of Alaska. Northw. Med. 49:340-341, 1950.

14. Williams, R. B. and M. W. Dodson. Salmonella in Alaska. Public Health Rep. 75:913-916, 1960.

15. Wilson, A. N. and R. Baade. Salmonellosis traced to seagulls in Ketchikan area. Alaska Med. 1:18-19, 1959.

1195-65