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A SURVEY OF Q FEVER ANTIBODIES IN A HIGH RISK POPULATION IN PANAMÁ

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Abstract. While Q fever is considered an occupational hazard of persons associated with livestock, and cattle raising is a major industry in Panamá, little or no data have been available on the status of Q fever infection in that country. Accordingly, the prevalence of complement-fixing antibodies to *Coxiella burnetii* was investigated in a random selection of 1,059 specimens from 4,700 sera collected in 1968–1969 from people associated with livestock or their by-products in a country-wide survey. Sera were tested by a modifed diagnostic complement-fixation test adapted to the microtiter technique. Of the 1,059 samples examined, 99 (9.4%) contained Q fever complement-fixing antibodies with titers ranging between 1:4 and 1:32 or greater. Positive sera were found among residents in three provinces in central Panamá (Herrera, 20.2%; Panamá, 14.5%; and Los Santos, 13.7%). The lowest rate (2.1% positive) was found in Chiriquí province in western Panamá. These differences are significant. The overall rate (9.4%) found in those in contact with livestock was five times higher than that found in an earlier survey in 1966 among a cross-section of the population in which only 1.8% were positive. Positive sera were found most frequently in those aged 15–19 years (12.4%) and least often in the 10–14 (7.3%) age group. Those who worked in rustic rural slaughterhouses were most frequently positive (16.8%), compared to those in modern abattoirs (8.8%), butcher shops (9.4%), or dairy farms (9.4%). While clinical Q fever was not identified, the association of human infection with the livestock industry is confirmed.

The first recognized case of Q fever in Central America was found by Cheney and Geib in 1946 while studying the etiology of atypical bronchopneumonia in an American soldier stationed in the Panama Canal Zone.[1] One year later, Rodaniche and Rodaniche serologically diagnosed two cases of Q fever in Panamanians and isolated *Coxiella burnetii* from one of the cases.[2,3] During the following 20 years, to our knowledge, no subsequent effort was undertaken to uncover additional cases of Q fever in Panamá.

In 1966 a search for rickettsial antibodies in human sera from a cross-section of the population of Central America and Panamá was performed by complement-fixation and microagglutination tests at the Middle American Research Unit (MARU), and was reported by Peacock et al.[4] Over 2,000 human sera from six countries were surveyed for antibodies against rickettsial infection. The results indicated that Q fever was endemic in the area, with a relatively low prevalence of *C. burnetii* antibodies for Panamá. Of the 336 sera collected in Panamá 1.8% were positive, indicating that among the general population Q fever was not a public health problem.

While Q fever is considered an occupational hazard of persons associated with livestock, and cattle raising is a major industry in Panamá, little or no data have been available on the status of Q fever infection in that country, other than the three clinical cases diagnosed in local hospitals in 1946–1947.

In view of this, a serological survey of high-risk populations of persons who frequently have contact or are associated with livestock or their by-products seemed indicated to determine whether there were differences in prevalence of Q fever infection according to geographic regions, age, sex, occupation and other characteristics of the population in Panamá. Methods and reagents were used which would allow direct comparison with the 1966 study.

This study was facilitated by the availability of a collection of sera at the Gorgas Memorial Laboratory (GML) numbering approximately 4,700 specimens. The sera had been collected in 1968–1969 in 148 localities during a nation-wide brucellosis survey[5] from individuals associated with livestock or their by-products in seven of the nine provinces of Panamá.

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TABLE 1

Q fever antibodies in high-risk population by province, Panamá, 1968–1969

Province	No. exam.	No. pos.*	% pos.
Coclé	127	8	6.3
Colón	109	12	11.0
Chiriquí	239	5	2.1
Herrera	138	28	20.2
Los Santos	139	19	13.7
Panamá	159	23	14.5
Veraguas	148	4	2.7
Total	1,059	99	9.4

* Titers ≥1:4.

MATERIALS AND METHODS

All sera utilized for the study were stored at −20°C. A subsample of 1,059 sera was selected from the 4,735 sera maintained in the laboratory, by choosing every third serum in the butcher and cowboy groups, every 10th one in the milker groups, and all samples in the remaining occupational groups. Pertinent epidemiological data available for each individual serum in the subsample were recorded on a standard form. This information had been obtained by direct interview during the brucellosis survey,[5] and included age, sex, place of work, occupation, region of the country where employed (province), type of animals handled in employment, etc.

The reagents and techniques used in the present study were basically the same as those previously used in the Central American survey.[4] The complement-fixing antigen utilized for both surveys was from the same antigen lot, provided by the Rocky Mountain Laboratories, USPHS, Hamilton, Mont., USA. It was made from formalin-inactivated suspensions of yolk sacs infected with Nine-Mile strain of *C. burnetii* in phase II, by methods described by Fiset et al.[6] and Ormsbee.[7]

Sera were tested by the microtiter complement-fixation (CF) technique described by Fiset[8] at dilutions of 1:2 and 1:4 and antibody endpoints of the positive sera were determined by repeat titrations with doubling dilutions through 1:32. Serum titers ≥1:4 were considered positive.

RESULTS

Geographic distribution

Results of serological tests (Table 1) on individuals whose work brings them in contact with livestock and their products revealed antibodies to Q fever in all seven provinces surveyed. Of the 1,059 samples examined, 99 (9.4%) contained antibodies with titers ranging between 1:4 and 1:32 or higher. Prevalence rates were highest in three provinces of central Panamá (Herrera, 20.8%; Panamá, 14.5%; and Los Santos, 13.7%) and least prevalent in Chiriquí Province in western Panamá with 2.1% frequency. These differences are significant ($P < 0.001$).

Age group and sex

The age distribution data showed that positive sera were found most frequently in persons aged 15–19 years (12.4%) and lowest (7.3%) in the 10- to 14-year-old group. There was no increase in antibody prevalence with age, but in the age groups beyond 40 antibody rates remained constant. The presence of antibodies in males (9.6%) differed only slightly from those in females (7.1%). However, no statistical differences could be found among age groups, nor between sexes.

Place of work and occupation

Of the 1,059 individuals engaged in occupations associated with livestock and cattle-raising activities, persons who worked in rustic rural slaughterhouses were those most frequently positive (16.3%), compared to those in modern abattoirs (8.8%), butcher shops (9.4%), or dairy farms (9.4%). No antibodies could be demonstrated in the sera from individuals who worked in a sausage factory.

Table 2 compares the relative prevalence of Q fever antibodies among persons grouped by occupation. Positive serologic reactions were more common among butchers (12.1%), milkers (10.4%), cowboys (8.9%), and meat carriers (9.5%), than among the remaining occupational groups examined. Antibody was not detected in serum samples from either sausage makers or from hog raisers. The serological evidence of infection in butchers, milkers, and cowboys has added significance when grouped by geographic location of residence, as shown in Table 3. For these occupations, the highest prevalence rates were generally observed in the provinces of Colón, Herrera, Los Santos, and Panamá, in the central part of the country.

A total of 282 sera from butchers in seven provinces was tested for CF antibodies against Q fe-

TABLE 2

Q fever antibodies, by occupation, Panamá, 1968–1969

Occupation	Total sample	No. exam	No. pos.*	% pos.	Presumed positive total sample
Butcher	727	282	34	12.1	88
Milker	3,094	327	34	10.4	322
Cowboy	727	271	24	8.9	65
Meat carrier	22	21	2	9.5	2
Sausage maker	45	44	0	0.0	0
Cheese maker	64	62	4	6.5	4
Veterinarian	28	27	1	3.7	1
Hog raiser	28	25	0	0.0	0
Total	4,735	1,059	99	9.4	482 (10.2%)

* Titers ≥1:4.

ver. Prevalence reached a maximum of 22.0% in the sera from butchers in Panamá province, while high frequency rates, 17.0% and 17.1%, were observed in sera from butchers in Colón and Herrera provinces, respectively.

The highest prevalence of antibodies in milkers occurred in the central provinces of Panamá: Herrera (22.6%), Los Santos (16.7%), and Panama (15.6%), while prevalence was lower in sera from Chiriquí (1.9%) in western Panamá, and no reactors were detected from Veraguas province.

Q fever antibodies in cowboys reached the highest prevalence in the province of Los Santos (16.2%) and were slightly lower in Herrera (14.6%), Panamá (14.3%), and Colón (12.5%) provinces.

A significant difference was demonstrated between the overall rate of infection in the high-risk population (9.4%) and that found in the general population (1.8%) of Panamá.[4]

DISCUSSION

The results of this study of a high risk population in Panamá confirm the 1966 survey of a cross section of the general population of Central America which demonstrated that Q fever infection, although of low prevalence, was widespread in the general population.[4] In areas of all six countries, a small percentage (0.6%–2.6%) of the inhabitants possessed CF antibodies. The results also showed that Q fever does not seem to represent a public health problem for the general population of Panamá. On the other hand, a higher prevalence of infection with *C. burnetii* was revealed by the present study, among the occupationally exposed (high risk) segment of the Panamanian population in which the prevalence of seropositives (9.4%) was five times that found among the general population (1.8%).

There was no significant difference between the age groups surveyed, although an appreciable but

TABLE 3

Q fever antibodies in butchers, milkers, and cowboys by geographic residence, Panamá, 1968–1969

Province	Butchers			Milkers			Cowboys		
	Total sample	No. exam.	No. (%) positive*	Total sample	No. exam.	No. (%) positive	Total sample	No. exam	No. (%) positive
Coclé	45	28	1 (3.6)	330	54	4 (7.4)	46	37	2 (5.4)
Colon	99	47	8 (17.0)	15	15	1 (6.7)	25	24	3 (12.5)
Chiriquí	176	50	3 (6.0)	860	53	1 (1.9)	354	53	1 (1.9)
Herrera	83	35	6 (17.1)	836	53	12 (22.6)	64	41	6 (14.6)
Los Santos	83	42	4 (9.5)	800	54	9 (16.7)	46	37	6 (16.2)
Panamá	195	50	11 (22.0)	91	45	7 (15.6)	21	21	3 (14.3)
Veraguas	46	30	1 (3.3)	165	53	0	171	58	3 (5.2)
Totals	727	282	34 (12.1)	3,097	327	34 (10.4)	727	271	24 (8.9)

* Titers ≥1:4.

constant infection rate was reflected in the 40 and above age groups.

While clinical Q fever was not identified in our study, the association with the livestock industry is confirmed. There is a widespread distribution of antibodies throughout the country (Table 1), and reactors were found throughout all seven of the provinces surveyed with the highest rates encountered among persons engaged in occupations closely associated with the livestock industry in central Panamá. The data reveal that CF antibodies persisted at detectable levels and at meaningful rates, particularly among butchers, milkers, and cowboys, while in hog raisers and sausage makers the antibody prevalence rates were zero (Table 2). This probably reflects the fact that swine are resistant to infection with *C. burnetii*.[9]

Several factors may have contributed to the lack of diagnosed clinical cases in Panamá. Q fever infections in humans are usually self-limiting, and recovery precludes further efforts to identify etiology. The disease is classified as a febrile illness of unknown origin. Diagnostic laboratories in Panamá at present are not capable of isolating rickettsial agents, nor do they generally perform the necessary serological tests for proper identification of the infection. Consequently, inapparent infections or a mild, non-debilitating disease state may be the common form of human involvement in Panamá and thus go unrecognized, as has been recorded elsewhere.[10]

In most infections of humans, the organism is acquired by exposure to infected domestic animals such as cattle, sheep, and goats or their products. The high incidence of Q fever among slaughterhouse and dairy farm workers in many countries has incriminated cattle as the source of infection. *Coxilla burnetii* organisms are readily isolated from milk and placenta of cows. In beef herds, in which the animals are usually widely dispersed, infection rates are usually low, but in dairy herds, in which close contact of animals is inevitable, infection spreads rapidly.[11] This may explain the low prevalence rates encountered in Chiriquí and Veraguas provinces where the cattle are generally dispersed over large areas. Sheep and goats also are reservoirs of considerable importance in many countries. However, infection in these animals is nearly always inapparent since it does not affect their growth or milk production; hence, it persists unrecognized and is of no economic importance to the dairyman, beef raiser, sheep or goat rancher whose animals are infected with *C. burnetii*.[12] Nevertheless, these infected herds represent a public health menace because infected animals shed rickettsiae for long periods and in high concentrations in the milk, placenta, and uterine discharges after parturition. Cattle probably are the most common source of human infection in Panamá, since sheep and goats are practically nonexistent. The most common manifestation of infection is probably fever of undetermined origin in persons engaged in occupations associated with the livestock industry.

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