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Seroprevalence of *Rickettsia typhi* and *Rickettsia conorii* infections in the Canary Islands (Spain)

Margarita Bolaños-Rivero [a], Évora Santana-Rodriguez [a,b], Alfonso Ángel-Moreno [c,d], Michele Hernández-Cabrera [c,d], José-María Limiñana-Canal [e], Cristina Carranza-Rodríguez [c,d], Antonio-Manuel Martín-Sánchez [a,b], José-Luis Pérez-Arellano [c,d,*]

[a] *Servicio de Microbiología, Hospital Universitario Insular de Gran Canaria, Gran Canaria, Spain*
[b] *Departamento de Ciencias Clínicas, Universidad de Las Palmas de Gran Canaria, Gran Canaria, Spain*
[c] *Unidad de Enfermedades Infecciosas y Medicina Tropical, Hospital Universitario Insular de Gran Canaria, Gran Canaria, Spain*
[d] *Departamento de Ciencias Médicas y Quirúrgicas, Universidad de Las Palmas de Gran Canaria, Gran Canaria 35080, Spain*
[e] *Servicio de Bioestadística, Universidad de Las Palmas de Gran Canaria, Gran Canaria, Spain*

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SUMMARY

Objective: The aim of this work was to evaluate the prevalence of past infection due to *Rickettsia typhi* and *Rickettsia conorii* in the Canary Islands (Spain).
Methods: A representative sample of the population of the seven islands, formed of 662 people aged between 5 and 75 years (368 females, 294 males), was analyzed. Epidemiological data were obtained by direct survey. The detection of serum IgG antibodies against both microorganisms was based on an indirect immunofluorescence test, considered positive if the titers were $\geq$1/80.
Results: Of the analyzed population 3.9% had IgG antibodies against *R. typhi* and 4.4% against *R. conorii*. Out of these positive samples, only three were positive for both species. The seroprevalence was similar in both sexes. Positive results were found in all age groups, but a higher rate was noticed in those aged 46 years and older ($p < 0.05$). *R. typhi* was found to be more prevalent in rural areas of all islands, as well as in farmers.
Conclusions: Our results confirm the presence of antibodies against the causative agents of murine typhus and Mediterranean spotted fever in the Canary Islands. Indirect data suggest that the detection of antibodies to *R. conorii* might be due to a cross-reaction between these species.

1. Introduction

Infections caused by different species of the genus *Rickettsia* are a broad group of zoonoses with a worldwide distribution. However, depending on the species and the vectors involved in their transmission, the incidence of these infections varies significantly in different geographical areas.

Murine or endemic typhus is a zoonosis caused by *Rickettsia typhi*.[1] The classic biological cycle of *R. typhi* infection includes rats (*Rattus rattus* and *Rattus norvegicus*) as a reservoir and the oriental rat flea (*Xenopsylla cheopis*) as a vector. The usual way of transmission is percutaneous inoculation of the microorganisms present in flea feces. However, this classic cycle seems to have been replaced in some regions by the peri-domestic animal cycle (urban and suburban outbreaks) involving cats, dogs, opossums and their fleas (*Ctenocephalides felis*[2]). Inhalation of desiccated flea feces has also been described as an additional mechanism of transmission.[3] The disease usually presents as an acute febrile illness (7–28 days of duration) associated with headache and a skin rash.[4] Its distribution is worldwide, with endemic areas in the southern areas of the USA, South America, Australia, Southeast Asia, and Southern Europe.[5,6] The disease also occurs in Spain, as some reports of sporadic cases[7–12] and a few clinical series[13–16] have shown. In addition, some epidemiological studies in central,[17,18] northeastern,[19] and southern[20–22] Spain have shown a seroprevalence of *R. typhi* ranging between 3.8% and 18%.

Mediterranean spotted fever caused by *Rickettsia conorii* is endemic in some areas of Spain[17,23] and other Mediterranean countries, as well as in different areas of Asia and Africa. The disease is transmitted to humans by the bite of the brown dog tick, *Rhipicephalus sanguineus*, and usually manifests itself as a febrile illness with headaches, arthromyalgia, skin rash, and a characteristic black eschar ('tache noire') at the inoculation site.

Data on the seroprevalence of antibodies against the causative agents of both infections in the Spanish population are scarce, and no such study has ever been conducted in the Canary Islands. The aim of our study was to analyze the seroprevalence and epidemiology of *R. typhi* and *R. conorii* in the Canary Islands.

* Corresponding author. Tel.: +34 928 451455; fax: +34 928 451413.
E-mail address: jlperez@dcmq.ulpgc.es (J.-L. Pérez-Arellano).

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2. Subjects and methods

2.1. Characteristics of the geographic area

The Canary Islands are an archipelago of seven islands of volcanic origin in the Atlantic Ocean, located around latitude 27°–29° North and 14°–18° West. There are great differences between the islands with regard to their size and altitude (between 600 and 3700 m), which determine a great climate variability. The presence of trade winds and the actual relief of the islands of Fuerteventura and Lanzarote result in an arid climate, whereas the rest of the islands have different ecosystems.

The area in this study comprised the seven Canary Islands. The estimated population in 1996 was 1 606 549 people (50.4% female, 49.6% male), resulting in a population density of 219 people per square kilometer. The distribution by age was as follows: 20.6% younger than 16 years; 27.7% between 16 and 30 years; 22.5% between 31 and 45 years; 18.7% between 46 and 65 years; and 10.5% older than 65 years. The two main islands, Gran Canaria and Tenerife, account for 85.5% of the population.

2.2. Study method

We analyzed a representative sample of the population by obtaining sera associated with the 1998 National Survey on Nutrition[24] and preserving it at −70 °C until testing was performed. Informed consent was obtained from each subject, so that the serum could be used for our study. The study universe was constituted of the entire population aged between 5 and 75 years. The base population comprised every single person registered in the census. A two-stage sampling by conglomerates was performed, with the municipality (county) being the primary

Table 1
Cases of positive IgG titers (≥1/80) for *Rickettsia typhi* and/or *Rickettsia conorii* obtained from a representative sample (*N* = 662) of the general population on the Canary Islands (Spain)

Case	Age (years)	Sex (M/F)	Island	*R. typhi* (IgG)	*R. conorii* (IgG)
1	58	M	La Gomera	1/2560	≤1/40
2	61	F	La Palma	1/2560	≤1/40
3	46	F	Lanzarote	1/640	≤1/40
4	61	F	Tenerife	1/640	≤1/40
5	58	M	La Gomera	1/640	≤1/40
6	39	F	La Gomera	1/640	≤1/40
7	54	M	Tenerife	1/640	≤1/40
8	68	F	Gran Canaria	1/320	≤1/40
9	21	M	Tenerife	1/320	1/80
10	74	M	La Palma	1/320	≤1/40
11	15	F	El Hierro	1/320	≤1/40
12	70	M	La Palma	1/320	≤1/40
13	64	F	La Gomera	1/320	≤1/40
14	58	M	Fuerteventura	1/160	≤1/40
15	40	F	La Gomera	1/160	≤1/40
16	57	F	La Gomera	1/160	≤1/40
17	15	F	El Hierro	1/160	1/80
18	75	F	El Hierro	1/160	≤1/40
19	14	F	Gran Canaria	1/80	1/80
20	35	F	Gran Canaria	1/80	≤1/40
21	63	M	Tenerife	1/80	≤1/40
22	74	M	La Gomera	1/80	≤1/40
23	55	M	La Gomera	1/80	≤1/40
24	75	M	El Hierro	1/80	≤1/40
25	20	M	La Gomera	1/80	≤1/40
26	58	M	Gran Canaria	1/80	≤1/40
27	65	M	Fuerteventura	≤1/40	1/160
28	59	M	Gran Canaria	≤1/40	1/80
29	69	M	Gran Canaria	≤1/40	1/80
30	68	M	Gran Canaria	≤1/40	1/160
31	47	F	Gran Canaria	≤1/40	1/80
32	55	M	Tenerife	≤1/40	1/80
33	63	M	Tenerife	≤1/40	1/160
34	62	M	La Gomera	≤1/40	1/80
35	8	F	La Palma	≤1/40	1/80
36	54	F	La Palma	≤1/40	1/80
37	69	F	La Palma	≤1/40	1/160
38	8	M	El Hierro	≤1/40	1/80
39	51	F	Tenerife	≤1/40	1/80
40	59	M	Tenerife	≤1/40	1/160
41	69	M	Tenerife	≤1/40	1/80
42	14	F	Tenerife	≤1/40	1/160
43	44	F	Gran Canaria	≤1/40	1/80
44	53	F	Tenerife	≤1/40	1/320
45	64	F	Fuerteventura	≤1/40	1/80
46	63	F	Gran Canaria	≤1/40	1/80
47	61	F	Gran Canaria	≤1/40	1/80
48	44	M	Gran Canaria	≤1/40	1/80
49	63	M	El Hierro	≤1/40	1/80
50	31	M	Gran Canaria	≤1/40	1/80
51	26	M	Gran Canaria	≤1/40	1/80
52	66	M	Gran Canaria	≤1/40	1/80

IgG, immunoglobulin G; M, male; F, female.