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Serogroups of thermophilic campylobacters from humans and from non-human sources, Israel 1982–1985

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SUMMARY

The distribution of serogroups of thermophilic campylobacters isolated in Israel from human patients (2421 isolates), chicken (942), turkeys (158), cattle (398), wild birds (234) and other sources, was studied.

Among the human isolates, 74 ROG-serogroups were identified. The six most commonly isolated of these (1,18; 11; 12; 8,23; 4 and 5,39) were found frequently in chickens. Only four common serogroups in man were also common in cattle, three in turkeys and two in wild birds.

Two common serogroups in man (1,18 and 5,39) were prevalent all over the country, while others were regionally distributed. When the prevalence of different serogroups in Israel was compared to that in Canada, some groups were common to both countries and others were common in only one or the other.

Campylobacter jejuni accounted for 86·7% to 92·1% of the isolates from man, chickens, turkeys, cattle and most of the wild birds. *C. coli* was found in 34·4% of isolates from cattle egrets and in 76·5% of those from pigs.

INTRODUCTION

The role of *Campylobacter jejuni* and *C. coli* as a common cause of enteritis in man is now well known. The significance of domestic and wild animals or birds as sources of infection (Blaser *et al.* 1980) is less clear.

As in other zoonoses, the clarification of the epidemiology of human campylobacteriosis is based upon serotyping procedures. Different schemes have been proposed, based on identification of heat-stable (Penner & Hennessy, 1980) or heat-labile antigens (Lior *et al.* 1982; Lior, 1984; Rogol *et al.* 1982, 1983).

This study presents an analysis of thermophilic campylobacters isolated from man and other sources over a 4-year period in Israel.

MATERIALS AND METHODS

During the 4-year period 1982–85, 4347 strains of thermophilic campylobacters, isolated in medical and veterinary laboratories, were studied in the National Centre for Campylobacter, Jerusalem. Most of the isolates were transported to the National Center as fresh cultures in thioglycollate medium to which some drops of

Table 1. *Sources of isolates of campylobacter, Israel 1982–5*

Source	No. of cultures	Source	No. of cultures
Humans	2421	Dogs	16
Chicken	942	Cats	2
Turkeys	158	Monkeys	11
Geese	31	Wild birds	234
Cattle	398	Environment	100
Pigs	34		
	Total	4347	

Table 2. *Main serogroups of* Campylobacter jejuni *and* C. coli *isolated from patients, Israel 1982–5 (total no. of isolates 2421)*

ROG-serogroups	No. of isolates	Percentage
	Campylobacter jejuni	
1,18	225	9·3
11	191	7·9
12	167	6·9
8,23	149	6·2
4	134	5·5
5,39	128	5·3
28	89	3·7
9	86	3·6
3	63	2·6
29	60	2·5
26	59	2·4
2	53	2·2
17	46	1·9
49	45	1·9
13	43	1·8
24	38	1·6
15	37	1·5
16	37	1·5
35	37	1·4
	Campylobacter coli	
12	18	0·7
13	18	0·7
2	17	0·7
4	14	0·6
8,23	12	0·5
11	11	0·5

defibrinated human blood were added. The isolates were subcultured on solid selective media and in BEM enrichment medium without antibiotics (Rogol *et al.* 1985). For further examination, the cultures were preserved at −80 °C in fluid thioglycollate medium containing 35% glycerol and a frew drops of defibrinated human blood.

The sources of the isolates are presented in Table 1. Serotyping was performed according to the ROG scheme (Rogol *et al.* 1982, 1983) developed in the National Center for Campylobacter, Jerusalem. This method, which is similar to that of

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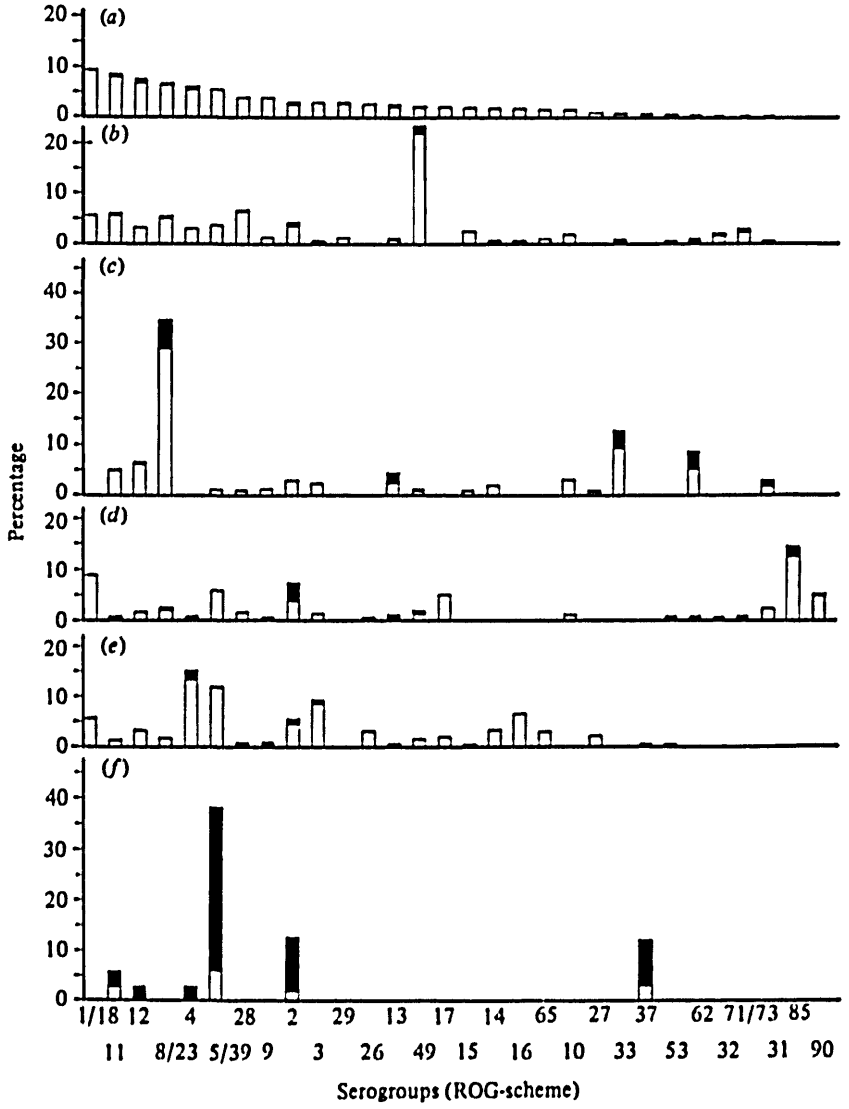

Fig. 1. Distribution of serogroups of *Campylobacter jejuni* and *C. coli* isolated from (*a*) patients (2421 strains), (*b*) chicken (942 strains), (*c*) turkeys (158 strains), (*d*) wild birds (234 strains), (*e*) cattle (398 strains), and (*f*) pigs (34 strains). □, *C. jejuni*; ■, *C. coli*.

Lior (Lior *et al.* 1982; Lior, 1984) is based on slide agglutination of a suspension in PBS from a fresh culture on a blood agar slant, using sera prepared to react with heat-labile antigens. The ROG scheme, published first in 1982, was extended in 1983 to comprise 34 serogroups. During the further years it was supplemented with new sera and part of the sera were absorbed with heterologous live cultures or homologous boiled cultures, to avoid most of the cross-reactions. The scheme is based on the use of 90 sera prepared against 65 human reference strains, 22 strains from chickens, 1 from calves, 1 from a pigeon and 1 from a crow. Of these reference strains, 71 were *C. jejuni*, 18 *C. coli* and 1 *C. laridis*.

For practical purposes the 90 sera were combined into ten polyvalent pools for

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Table 3. *Relative frequency of main ROG-serogroups of thermophilic campylobacter from humans and from other sources (1982–5)*

ROG-serogroup	Percentage of isolates				
	Humans (2421)*	Chickens (942)*	Turkeys (158)*	Cattle (398)*	Birds (234)*
1,18	9·5	5·8	—	5·8	9·0
11	8·3	6·2	5·1	—	—
12	7·6	3·2	6·9	3·5	1·7
8,23	6·7	5·5	34·8	1·8	2·6
4	6·1	3·0	—	15·0	—
5,39	5·5	3·6	—	12·0	6·0
28	3·9	6·6	—	—	1·7
9	3·7	—	—	—	—
2	2·9	4·3	2·5	5·8	7·3
3	2·7	—	1·9	9·5	—
20	2·7	—	—	—	—
26	2·6	—	—	3·0	—
13	2·5	—	4·4	—	—
49	2·1	23·4†	—	—	2·1
17	1·9	—	—	2·0	5·1
15	1·9	2·4	—	—	—
24	1·7	—	—	1·8	—
16	1·6	—	—	6·8	—
14	1·6	—	1·9	3·5	—
35	1·5	1·3	—	—	—
71,73	—	3·1	—	—	—
32	—	2·0	—	—	—
64	—	1·9	—	—	—
10	—	1·7	3·2	—	—
33	—	—	13·3	—	—
62	—	—	8·9	—	—
31	—	—	3·2	—	2·6
47	—	—	1·9	—	—
65	—	—	—	2·8	—
27	—	—	—	2·3	—
20	—	—	—	1·8	—
85	—	—	—	—	14·9
90	—	—	—	—	5·1
41	—	—	—	—	1·7
Total	77·0	74·0	88·0	77·4	59·8
Other serogroups	20·6	19·9	7·6	19·1	19·7
Non typable	2·2	4·8	4·4	3·3	20·1
Autoagglutinable	0·2	1·3	—	0·2	0·4

* Number of isolates examined. † Most of these belonged to an outbreak in chicken.

screening. More recently, two polyvalent pools were prepared based on the prevalence of serogroups in man; these two polyvalent sera react with 70–80% of the human isolates in Israel. Final typing was with individual sera.

Identification of species was made on hippurate hydrolysis (Hipp + or −) and susceptibility to nalidixic acid (commercial disks containing 30 μg/disk) (NA sens. or res.) as recommended (Skirrow & Benjamin, 1980). This method differentiates three species among the thermophilic campylobacters: *C. jejuni* (Hipp. +, NA sens.), *C. coli* (Hipp.-, NA sens.) and *C. laridis* (Hipp.-, NA res.).

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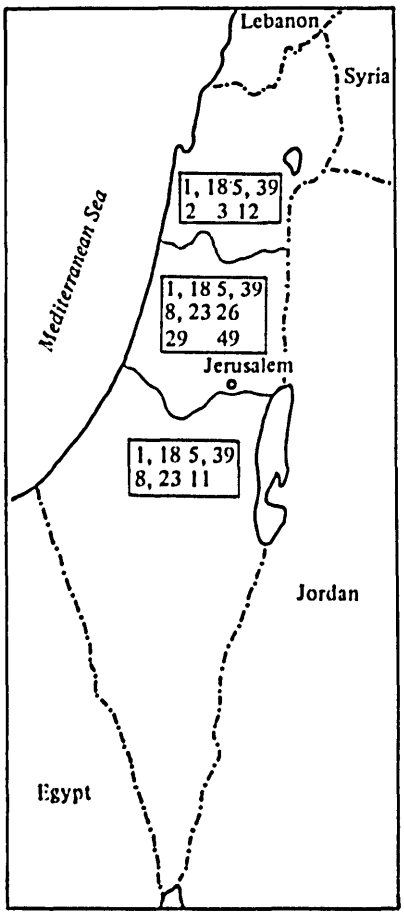

Fig. 2. Regional distribution of the common serogroups of the thermophillic campylobacters from patients in Israel, 1985.

RESULTS

Campylobacter in man

During the period under study 2421 cultures from human cases of enteritis were examined. Most of them belonged to apparently sporadic cases or to small family outbreaks, though some larger outbreaks were also reported. One, in which 150 persons were affected, was probably waterborne (Rogol *et al.* 1983). Most of the isolates in this outbreak belonged to serogroup 17, but two were of other serogroups (15 and 24). Another outbreak, in which all the isolates belonged to serogroup 11, took place in a military camp (Cohen, Rowach & Rogol, 1984). A third outbreak was in a kibbutz, and all the 15 isolates of campylobacter were of serogroup 1,18.

The isolates of human origin belonged to 74 serogroups of *C. jejuni* and 25 of *C. coli*. The first 20 serogroups of *C. jejuni* and the first 6 of *C. coli*, in order of frequency of isolation, are presented in Table 2. The first nine serogroups of *C. jejuni* comprise more than half of all the human isolates.

Most of the isolates from man (92·1 %) were *C. jejuni*, 7·9 % were *C. coli* and only

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Table 4. *Comparison between the frequency of common ROG-serogroups of campylobacter in Israel and the corresponding LIOR-serogroups in Canada*

ROG-serogroups (Israel)			LIOR-serogroups		
Serogroup	Percentage		Serogroup	Percentage	
1,18	9·5	24·4	2;36	10	40·5
4	6·1		4	17	
5,39	5·1		5;6;5,6	7·5	
9	3·7		11	6	
11	8·3	19·8	30		
12	7·6		44	rare	
28	3·9		42		
35	rare		1	14	20·0
14			7	10	
43			17	5	

three strains were *C. laridis*. Serogroups 2, 13, 15 and 49 contained a higher proportion of *C. coli* than others (Fig. 1).

Serogroups of thermophilic campylobacters from other sources

The relative frequency of isolation of the main serogroups found in chickens, turkeys, cattle and wild birds was compared with that in man (Table 3).

A tentative comparison was made of the relative frequencies of common serogroups found in humans in Israel with those in Canada. Twenty-seven reference strains of the LIOR scheme were examined with the sera of our ROG scheme. Although a complete equivalence of serogroups was not established, we found a strong correlation between ten of the most frequently isolated ROG serogroups in Israel with the corresponding serogroups of the LIOR scheme (Lior, 1984) (Table 4).

Four serogroups were common in both countries; three of the common serogroups in Israel were rarely found in Canada and the other three common serogroups in Canada were rarely found in Israel. These findings illustrate the diversity of the serogroup distribution in the two countries.

DISCUSSION

The aim of this study was to estimate the relative frequency of isolation of different serogroups of the thermophilic campylobacters in Israel in order to try to elucidate the role of various sources of infection in the epidemiology of human campylobacteriosis.

The reservoirs of campylobacter have been studied in various countries (Luechtefeld *et al.* 1980; Blaser *et al.* 1983; Bolton, Dawkins & Hutchinson, 1985) and a high rate of infection was found, especially in fowl, pigs and cattle. In Israel campylobacter isolates were studied from the same sources and also from wild birds.

It is postulated that the distribution of serogroups found in man may be related to their distribution in various animal sources of infection.

Our main conclusions are as follows. Eight serogroups of thermophilic

campylobacters comprise more than half of all the isolates from patients in Israel. From the comparison of the frequency of isolation of serogroups from man and from other sources, chickens are the most likely source of infection for most of the frequent serogroups in man. Other associations between animals and strains found in man are turkeys and serogroups 8,23; 12 and 11; cattle and serogroups 4, 5,39 and 1,18; pigs and serogroup 5,39, and birds and serogroup 1,18. Some serogroups are common in animals but rare in man. These include serogroup 49 in chickens, serogroups 33, 62 and 13 in turkeys, serogroups 3 and 16 in cattle and serogroups 85, 2, 17 and 90 in birds. The proportion of *Campylobacter coli* among the thermophilic campylobacters was low in man (7·9% and cattle (6·5%); higher in birds, chickens, turkeys and geese (12·0–22·6%); and very high in pigs (76·5%).

Although two serogroups were prevalent throughout the country, the distribution of other common serogroups varied from region to region.

Comparison with findings in Canada further emphasized the geographical distribution in the prevalence of serogroups.

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