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OCCURRENCE OF ANTIBODIES TO GROUP SPECIFIC CHLAMYDIA ANTIGEN IN CATTLE IN VARIOUS AREAS OF FINLAND

By

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NEUVONEN, E.: *Occurrence of antibodies to group specific chlamydia antigen in cattle in various areas of Finland.* Acta vet. scand. 1979, *20*, 73—81. — The occurrence of group specific complement fixing antibodies was studied in 361 cattle sera from 36 herds in 6 areas in Finland. Sixty-two (17.2 %) were positive. The antibody frequency increased significantly from the south to the north and the frequency was significantly higher in forest than in field pastures. The reasons for the differences are discussed. The tick, Ixodes ricinus, perhaps has no significant epidemiological role in chlamydial epidemiology in Finland.

bovine chlamydial infections; group specific chlamydial antibodies.

Chlamydia psittaci is widespread in nature and causes clinical diseases in several species of animals (*Meyer* 1967). Most of the infections are subclinical. In calves the agent commonly causes enteritis (*Storz et al.* 1966), pneumonia (*Gorbanov* 1964), arthritis (*Kölbl & Psota* 1968) and encephalitis (*Mc Nutt* 1940). The most common chlamydial disease in adult cows is enzootic abortion (*Storz et al.* 1960). In bulls it has been found to cause disorders in the testis and accessorial sexual glands (*Storz et al.* 1968). Although clinical chlamydiosis is common in mammals in several European and American countries, very few cases of the disease have been reported in Scandinavia. Some ovine cases have been reported in Finland (*Estola & Salmela* 1970) and in Sweden (*Möllerberg & Jacobsson* 1972). In Finland chlamydia has been isolated in mink (*Estola*, unpublished information).

Only in Sweden (*Dinter & Bakos* 1961) and in Denmark (*Friis* 1967) has chlamydiosis been demonstrated in cattle.

In contrast to the few isolations of the agent in Scandinavia, serologically positive reactions are common. The prevalence of positiveness is 10—40 % assayed by the group specific complement fixation test (*Schjerning-Thiesen* 1964, *Friis, Neuvonen & Estola* 1974, *Rønsholt* 1977). A higher antibody frequency has been documented in cattle and reindeer in northern Finland than in the southern and central parts of the country (*Neuvonen* 1976).

Chlamydial infection is known to spread mainly orally and respiratorally. It has also been considered possible that chlamydia is transmitted by arthropod vectors (*Eddie et al.* 1969).

This article presents the results of studies on the frequency of chlamydial antibodies and their age distribution in 6 areas in Finland and discusses possible reasons for the variations.

MATERIALS AND METHODS

Bovine sera

Three hundred and sixty-one sera were collected from animals 1 year old or older in the 36 herds investigated during December 1977 and January 1978. The sera from Önningeby were collected in January 1977. About 90 % of the cattle investigated were of Ayrshire breed and the rest were Finncattle.

Herds

Six herds were selected from each of 6 geographical areas in Finland (Fig. 1). In Pieksämäki there were 6 herds from both tick-populated and tick-free farms (Pieksämäki II and I). The districts could differ in their pastoral character (Table 1). The herds were small and medium-sized dairy herds consisting on average of 10 animals (4—24). Their hygiene, production level and age distribution were roughly comparable. Loimaa, Alajärvi and Pieksämäki I belonged to the main pastoral type of cattle husbandry in Finland.

Antibody assay

Antibodies of Chlamydia psittaci were assayed using the group specific microcomplement fixation test (*Neuvonen & Estola* 1974). The antigen was the commercial ornitose antigen,

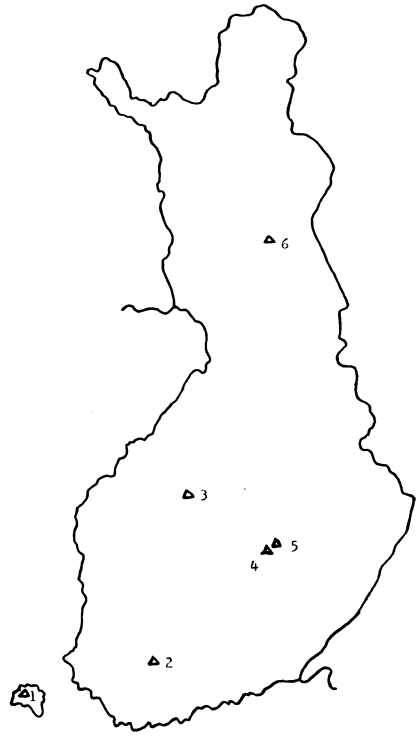

Figure 1. Geographical origin of the tested bovine sera in Finland.

Table 1. Number of samples, type of pasture and occurrence of ticks in summer time on the pastures of the herds tested.

Area	Number of herds	Total number of sera	Type of pasture	Occurrence of ticks*
Önningeby	6	59	field + bush	+++
Loimaa	6	95	field	—
Alajärvi	6	48	field	—
Pieksämäki I	6	60	field	—
Pieksämäki II	6	45	forest	++
Kemijärvi	6	54	field	—
Total	36	361		

* Frequency of ticks according to *Öhman* (1961):
— nil
\+ low
++ fairly high
+++ high

strain P-4 (Behringwerke). A titer of 1:16 or higher was considered positive.

The routine statistical methods were used for the statistical calculations.

RESULTS

Antibodies were found in 62 of the 361 samples (17.2 %) (Table 2). Positive titers were rather low. Most of the positive titers were 1:16. Four sera had titers of 1:32, 2 in Alajärvi and

Table 2. Prevalence of clamydial CF antibodies in bovine sera in 6 areas in Finland.

Area	Number of sera	Number of posit. sera (>1:16)	Titers				Percentage of positive sera
			1:32	1:16	<1:8	1:8	
Önningeby	59	1		1		58	1.7
Loimaa	95	10		10	14	71	10.5
Alajärvi	48	8	2	6		40	16.6
Pieksämäki I	60	8		8	4	48	13.6
Pieksämäki II	45	17		17	5	23	37.7
Kemijärvi	54	18	2	16	3	33	33.3
Total	361	62	4	58	26	273	17.2

2 in Kemijärvi, all in different herds. The highest prevalence was in cattle of the forest pasture in Pieksämäki II (37.7 %) and the lowest in Önningeby (1.7 %). Statistically the antibody frequencies in Kemijärvi (33.3 %) and in Pieksämäki II (37.7 %) did not differ significantly in the χ^2-test. Neither did the common prevalences of Pieksämäki I (13.6 %) and Alajärvi (16.6 %) differ significantly from Loimaa (10.5 %) in the t-test ($t = 0.57$). But the prevalences of Pieksämäki I differed significantly from the prevalences of Pieksämäki II ($t = 4.14^{**}$) and Kemijärvi ($t = 3.30^{**}$). The prevalence of Loimaa differed significantly from the prevalence of Önningeby ($t = 2.78^{*}$, $0.02 > P > 0.01$). The age distribution shows no differences between the group of animals aged 1—2 years, 2—4 years and those over 4 years old (Table 3). The percentage of 1—2 years old animals is 17.3 %, of 2—4 years old 16.2 % and of over 4 years old 18.1 %. The frequency of antibodies of the herds within the areas tested seems to be of the same level (Table 4).

Table 3. Percentage of positive sera in age groups.

Area	1—2 years old	2—4 years old	over 4 years old
Önningeby	0/1*	0/33	1/25
Loimaa	0/2	5/42	5/51
Alajärvi	0/5	5/25	3/18
Pieksämäki I	1/6	3/28	4/26
Pieksämäki II	1/4	7/20	9/21
Kemijärvi	2/5	8/25	8/24
Total	4/23 = 17.3 %	28/173 = 16.2 %	30/165 = 18.1 %

* Number of positive sera/total number of sera.

Table 4. Prevalence of chlamydial CF antibodies in bovine sera of the investigated herds.

Area	Herd No.					
	1	2	3	4	5	6
Önningeby	0/10*	0/11	0/8	1/9	0/10	0/11
Loimaa	3/12	2/13	1/24	1/10	1/18	2/18
Alajärvi	1/10	1/10	3/10	1/4	2/10	0/4
Pieksämäki I	1/9	1/10	1/11	2/10	0/10	3/10
Pieksämäki II	4/12	2/6	1/4	4/9	4/8	2/6
Kemijärvi	3/7	4/14	4/12	4/7	2/8	1/6

* Number of positive sera/total number of sera.

DISCUSSION

The average antibody frequency in Finnish cattle and in other domestic animals seems to be generally at the same level as in Central Europe (*Kaaden & Liebermann* 1966) and in Denmark (*Rønsholt* 1977). Outbreaks of the disease increase antibody frequencies in populations.

The lack of suitable species specific methods necessitates the use of group specific methods, for instance the complement fixation technique. It assays group specific antibodies induced by all the chlamydial agents. No conclusion can be drawn regarding the possible serological and pathogenic variants existing in populations and the influence they might have on the results. Generally, the CF method is considered reliable for the diagnosis of chlamydial infections. The group specific chlamydia antigen is not known to crossreact with heterological antibodies (*Kinjo*

& Bankowski 1966, *Maierhofer & Storz* 1969). The drawback of the CF test is its low sensitivity and rather late appearance of positivity after infections (*Storz et al.* 1971). CF antibodies persist for a few months only, which affects the prevalences recorded. Therefore, the positive reactions are induced by quite recent active infections. In addition to exogenous infections, activation of latent infections may also explain the presence of positive measurable antibodies. The frequency of such activations in cattle is not known.

The relative amount of different titers is for some reason unexpected. The number of 1:8 titers is smaller than the number of 1:16, although normally the positive cases decrease when the titer increases. The reason for the abnormal positivity pattern is not known.

The positive titers are low. Four sera out of 62 have titers of 1:32 and the rest 1:16. The general lowness of the positive titers concurs with earlier studies (*Neuvonen* 1976). It may suggest together with the absence of clinical outbreaks and failed isolations that the Finnish chlamydial strains are pathogenically weak and antigenically heterogeneous. The size of the infection doses and infection ports also influence the lowness of the titers. The antibody titers were low also in the previous ovine outbreaks of chlamydiosis in Finland, and antibody titers were also common in healthy animals (*Estola* 1970, *Estola & Salmela* 1970). Whether the reasons for ovine chlamydial outbreaks and lack of bovine cases are different variants and/or different epidemiology of the infection is still an open question.

It is generally known that chlamydiosis spreads mainly orally and through the respiratory routes. The samples for this work were collected from herds with roughly equal numbers of animals, and as far as was known with comparable hygienic and productive conditions. The aim was to eliminate in this way the influence of conventional husbandry conditions and to search for other factors which might explain the differences in chlamydial antibody frequencies found earlier between the northern and southern parts of Finland (*Neuvonen*).

Chlamydia psittaci has been isolated in various species of arthropods like ticks (*Eddie et al.* 1969), and the ticks have been thought to be potential vectors or carriers of chlamydiosis (*Eddie et al.*), although there is no direct epidemiological evidence. In this work, the exclusive tick in Finland, Ixodes rici-

nus, has not been demonstrated to play a major epidemiological role in chlamydiosis. In Önningeby, where there are plenty of ticks, there is a very low antibody frequency (1.7 %), whereas in Kemijärvi the frequency of titers is high but there are no ticks (*Öhman* 1961). However, in the Pieksämäki area, cattle in tick populated forest pastures had a significantly higher antibody frequency than cattle in field pastures with no ticks.

The reason for the difference is not clear. It does not confirm a role for Ixodes ricinus in chlamydial epidemiology. Some other factors in the forest pastures might be involved. The antibody frequencies in Loimaa, Alajärvi and Pieksämäki I are at the same level. In those areas the cattle are grazed in fields and the antibody frequency is significantly lower than in Pieksämäki II.

The antibody frequency increased from the south to the north similarly to the geographical antibody distribution of the Inkoo virus spread by mosquitoes (*Brummer-Korvenkontio* 1973). The antibody frequency was higher in forest pastures than in fields. There is little information on the distribution of mosquitoes in Finland, but it is known that the number of mosquitoes increases in summer time from the south to the north. Recent studies (*Utrio* 1978) show the number of some species of mosquitoes, particularly Aedes punktor, to increase very strongly in the north. It is not known whether the mosquitoes generally or some special species are in some way able to spread Chlamydia psittaci. The results presented above, especially the high antibody frequency in the north and Pieksämäki II, give reason to continue epidemiologic investigations of chlamydiosis to discover the role of mosquitoes and other arthropods.

The antibody frequencies by herds within each area are similar (Table 4). It makes the differences between the areas even more evident. In Kemijärvi only, herd No. 6 has a rather low prevalence, 1/6 of the sera are positive. The similar antibody prevalence in all the investigated age groups accords with the short lifetime of CF antibodies and supports the hypothesis of a pathogenically mild or several mild strains existing in the cattle population of Finland.

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SAMMANFATTNING

Förekomsten av antikroppar mot gruppspecifikt Chlamydia-antigen i nöt på några orter i Finland.

Förekomsten av gruppspecifika komplementbildande antikroppar undersöktes i 361 nötsera från 36 besättningar på 6 orter i Finland; 61 (17.2 %) var positiva. Förekomsten av antikroppar stiger signifikant från söder till norr, och på ett undersökt skogsbete är förekomsten signifikant högre än på åkerbeten. Orsaken till skillnaderna diskuteras. Fästingen, Ixodes ricinus, har kanske inte någon större betydelse i epidemiologin av Chlamydia psittaci i Finland.

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