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COLOSTRAL TRANSFER IN THE GOAT OF ANTIBODIES AGAINST CORYNEBACTERIUM PSEUDOTUBERCULOSIS AND THE ANTIBODY STATUS OF KIDS DURING THE FIRST 10 MONTHS OF LIFE *

By

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LUND, ARVE, TORBJØRN ALMLID, TORSTEIN STEINE and HANS JØRGEN LARSEN: *Colostrum transfer in the goat of antibodies against Corynebacterium pseudotuberculosis and the antibody status of kids during the first 10 months of life.* Acta vet. scand. 1982, 23, 483—489. — Serum and colostrum samples from goats at parturition and serum samples from their kids at 3 days and at 4, 7, 10 and 12 weeks after birth were examined for the presence of antibodies to Corynebacterium pseudotuberculosis hemolysins. The hemolysis inhibition test (HIT) was used. High correlation was found between titre values of antihemolysins in serum and colostrum of goats at parturition (correlation coefficient $r = 0.83$; $P < 0.01$). Intermediate correlation was found between antihemolysin titre in colostrum of goats and in the sera of their kids 3 days old ($r = 0.56$; $0.01 < P < 0.05$). Furthermore, titre values for 3 day-old kids showed high correlation with the antihemolysin titres when the kids aged 4 and 7 weeks ($r = 0.76$ and 0.85 , respectively; $P < 0.01$). Antihemolysin titres decreased linearly in kids from 3 days to 10 weeks old. Calculated half life of antibodies was 12 days. Most of the kids had detectable antibodies up to the age of 5—6 weeks. None of the kids were seropositive at 2½ months of age.

Serum samples collected monthly from a group of kids chosen at random, aged 7—10 months, contained antibodies to hemolysins in half of the animals at the first testing. At the age of 10 months 14 out of 15 kids were seropositive. Thus, most of the kids from this herd were exposed to *C. pseudotuberculosis* antigens during summer and autumn of their first year of life.

Prophylactic measures against caseous lymphadenitis is briefly discussed.

caseous lymphadenitis; Corynebacterium pseudotuberculosis; goats; kids; transfer of antibodies; time of infection.

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Few reports exist concerning colostral transfer of antibodies to *Corynebacterium pseudotuberculosis* (Syn. *C. ovis*) from goats to their kids, persistence of these antibodies in kids' sera and time of infection with *C. pseudotuberculosis*. *Burrell* (1981) examined 23 kids from 1 herd comprising 64 adult goats. Ten kids were seropositive in the hemolysis inhibition test. These kids were all, except one, less than 3 weeks of age and their mothers were seropositive. Only 2 kids developed clinical caseous lymphadenitis at about 6 months of age. *Burrell* (1980) also examined serum samples from lambs suckling naturally infected ewes and found antibodies to *C. pseudotuberculosis* toxin in 6 lamb sera. Antitoxin in serum samples from kids and lambs born to seropositive mothers indicated colostral transfer rather than post-parturient infection. *Burrell* (1979) recommended antitoxin tests to be used for immunity surveys in young lambs because of the occurrence of a clumping factor in their sera acting on bacterial cells. This clumping factor of non-antibody character made the agglutination test unreliable as a serological test for *C. pseudotuberculosis* infections.

Serological investigations of a herd of adult dairy goats showed that a majority of the animals examined had antibodies to *C. pseudotuberculosis* (*Lund et al.* 1982).

The purpose of this investigation was to study transfer of antibodies to *C. pseudotuberculosis* from dam to offspring, and to study the persistence of antibodies in kid serum. In addition it was of interest to find out when the kids became infected. Such information is important from an epidemiological point of view and in order to institute prophylactic measures against caseous lymphadenitis.

MATERIAL AND METHODS

Animals

The animals belonged to a herd of 80—90 dairy goats of Norwegian breed and have been described previously (*Lund et al.* 1982).

Serum and colostrum samples

Blood and colostrum samples were collected from 24 goats within 30 min after parturition. Blood samples were drawn from their kids at 3 days, and at 4, 7, 10 and 12 weeks after birth (Table 1). Blood samples were also collected from 17 kids chosen

at random, when they were 7, 8, 9 and 10 months old. Two of these were slaughtered at 8 months of age.

Table 1. Age distribution of goats and number of their kids examined when 3 days old.

Age, years	Number of goats	Number of kids, 3 days old		
		single	twin	triplet
2	7	4	6	
3	8		16	
4	4	1	4	3
5	2	1	2	
6	2		4	
7	1		2	
Total	24	6	34	3

Sera and colostrum samples were prepared according to standard procedures and stored at -20°C .

Serological test

The hemolysis inhibition test was used to detect antibodies to *C. pseudotuberculosis* hemolysins in sera and colostrum samples. The test was carried out as previously described by Lund *et al.* (1982).

RESULTS

Average antihemolysin titres in serum and colostrum samples of goats at the day of parturition and in sera from their kids at 3 days, and at 4, 7, 10 and 12 weeks after birth are presented in Table 2. No significant difference was found between titre values in serum and colostrum of the dams or between these and serum from their offsprings at 3 days of age. Average titre in the kids' sera decreased during the first 3 months of life. None were seropositive when 2½ months old. Most of the kids were seropositive up to 5–6 weeks of age. Analysis showed correlation between antihemolysin titres in serum and colostrum of goats, the correlation coefficient (r) being 0.83 ($P < 0.01$). Intermediate correlations were found between the titre values of serum of the kids and those of serum and colostrum of their dams, r being 0.56 and 0.51, respectively ($0.01 < P < 0.05$). High correlations were calculated between titre values in sera taken from kids at

Table 2. Average titres \pm standard deviation (s) of antihemolysins to *Corynebacterium pseudotuberculosis* in serum and colostrum of goats at parturition and in serum from their kids at 3 days, and at 4, 7, 10 and 12 weeks after birth (number of animals sampled in brackets).

Samples			Average titer \pm s*
Goats	Serum	(24)	2.06 \pm 0.63
	Colostrum	(24)	2.22 \pm 0.73
	Serum, 3 days	(43)	2.38 \pm 0.52
	Serum, 4 weeks	(30)	1.63 \pm 0.54
Kids	Serum, 7 weeks	(26)	1.03 \pm 0.50
	Serum, 10 weeks	(30)	0.53 \pm 0.44
	Serum, 12 weeks	(30)	0.09 \pm 0.24

* \log_{10} reciprocal value of endpoint titer.

3 days and at 4 and 7 weeks of age, r being 0.76 and 0.85, respectively ($P < 0.01$). A highly significant correlation was found between antihemolysin titres of 3 day-old siblings ($r = 0.88$; $P < 0.01$).

A halflife of 12 days for maternal antihemolysins in kid

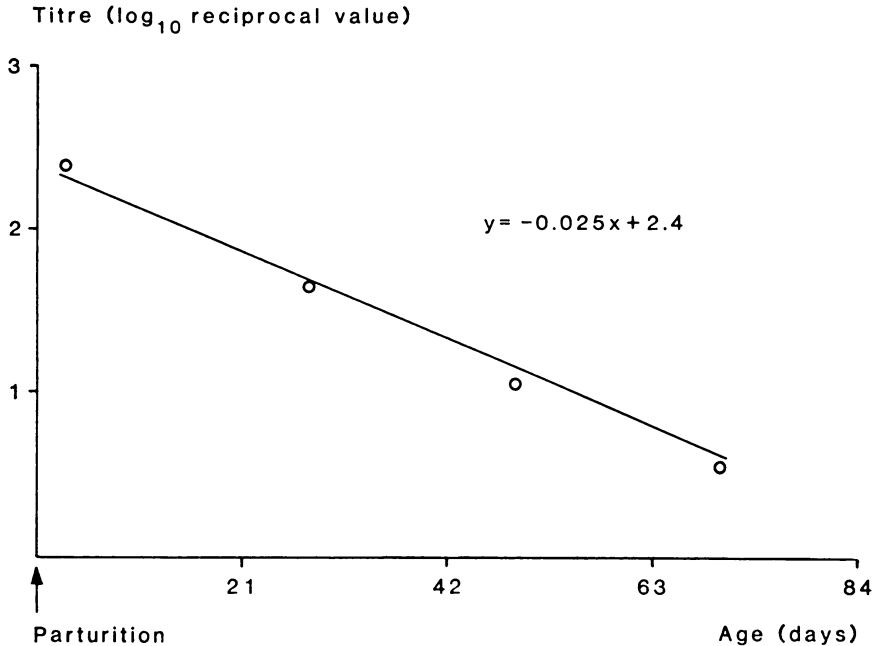


Figure 1. Regression line based on titre values of antihemolysins to *Corynebacterium pseudotuberculosis* in serum samples from kids aged 3 days, 4, 7 and 10 weeks.

serum was calculated from the equation for the regression line in Fig. 1 ($y = -0.025x + 2.4$). The antihemolysin titre declined linearly by 0.025 units pr. day.

The number of seropositive kids aged 7, 8, 9 and 10 months against *C. pseudotuberculosis* was 8 out of 17, 9 out of 16, 12 out of 15 and 14 out of 15, respectively. Thus by the age of 10 months nearly all the kids were seropositive.

DISCUSSION

High correlation was found between *C. pseudotuberculosis* antihemolysin titres in serum and colostrum of goats at parturition and intermediate correlation between titre values in colostrum and kid serum 3 days of age. These results are in accordance with those presented by *Le Jan et al.* (1978) concerning transfer of antibodies to echtyma virus from immunised pregnant sheep. Also, *Larson et al.* (1974) demonstrated positive correlation between titre values of antibodies to *Escherichia coli* in sera from lambs and the Ig-concentration in colostrum from their dams. *Halliday* (1978) claimed that when ewes have excess of colostrum for their lambs, significant correlation exists between the IgG concentration in colostrum and that in lamb serum. The goats examined in the present investigation were high-yielding dairy goats that most probably had excess of colostrum for their kids. Furthermore, the high correlation between antihemolysin titres in siblings supports this assumption. Correlations as presented are therefore to be expected. High correlations were also shown between titre values of antihemolysins in serum samples from kids aged 3 days and kids 4 and 7 weeks old. *Halliday* (1974) reported highly significant correlation between Ig-concentration in sera from lambs 2 and 10 days of age.

A halflife of 12 days was calculated for maternal antihemolysins in kid serum. According to *Smith et al.* (1976) halflife for maternal IgG in lamb serum is 13.7 days, while halflives for IgM and IgA were found to be 4.1 and 1.8 days, respectively. Thus, it is assumed that *C. pseudotuberculosis* antihemolysins belong to the IgG class.

Most of the kids had antihemolysins against *C. pseudotuberculosis* up to 5–6 weeks of age. *Burrell* (1980) demonstrated antihemolysins in sera of lambs aged 5–8 weeks. By clinical examination of kids less than 6 months old, *Ashfaq & Campbell*

(1979) reported a rather low prevalence of caseous lymphadenitis (< 0.29 %). Clinical caseous lymphadenitis is rarely diagnosed among kids less than 3 months, and during the first 12 weeks of life, titre increase in the kids was not observed. Thus, maternal antibodies together with environmental and other factors most probably protect the kids against *C. pseudotuberculosis* infection. Some authors report that *C. pseudotuberculosis* antitoxin is of importance for immunity against caseous lymphadenitis (Nairn *et al.* 1977). Our results indicate that infection with *C. pseudotuberculosis* occurs during summer and autumn before the kids are 1 year old. Previous investigations of goats from the same herd showed that the majority of yearlings have anti-hemolysins to *C. pseudotuberculosis* in serum (Lund *et al.* 1982). Our results indicate that immunoprophylaxis against caseous lymphadenitis caused by *C. pseudotuberculosis* in kids should be introduced at an age of 2—3 months. Other measures to prevent spread of infection are relevant particularly during the first year of life. Such measures should include careful examination when introducing animals into the herd as well as isolation and treatment of affected goats. In addition, it is important to consider objects in the pens which easily cause skin wounds representing "locus minoris resistentiae". Before introduction of animals into herds with low incidence of caseous lymphadenitis, it would be advisable to check the degree of infection in the donor herd of goats. For this purpose hemolysis inhibition test should be suitable.

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SAMMENDRAG

Overføring av antistoffer mot Corynebacterium pseudotuberculosis fra geiter til kje og antistoff status hos kje de første 10 levemåneder.

Serum- og kolostrum-prøver fra geiter ved partus og serumprøver fra deres kje 3 dager, 4, 7, 10 og 12 uker etter fødsel ble undersøkt ved bruk av antihemolysintest (AHT) for antistoffer mot *Corynebacterium pseudotuberculosis* hemolysiner. Det var høy korrelasjon mellom titerverdiene av antihemolysiner i serum og kolostrum hos geitene ($r = 0,83$; $P < 0,01$), og middels høy korrelasjon mellom antihemolysintiter i kolostrum hos geitene og i serum hos deres 3 dager gamle kje ($r = 0,56$; $0,01 < P < 0,05$). Titerverdiene hos 3 dager gamle kje viste videre en høy korrelasjon med serumtiteret hos kjeene ved 4 og 7 ukers alder (henholdsvis $r = 0,76$ og $0,85$; $P < 0,01$). Titerverdiene av antihemolysiner avtok linært hos kje i alderen 3 dager til 10 uker. Halveringstiden ble utregnet til 12 dager. Storparten av kjeene hadde positive titerverdier fram til 5—6 ukers alder. Ved 2½ måneders alder var ingen kje seropositive.

Ved undersøkelse av en gruppe kje i alderen 7—10 måneder, ble det påvist antihemolysiner hos halvparten av dyra ved første prøveuttak. Ved 10 måneders alder var 14 av 15 kje seropositive. De fleste kjeene fra den undersøkte besetningen fikk således antigen kontakt med *C. pseudotuberculosis* i løpet av sommeren og høsten første leveår.

Tidsrom for iverksetting av eventuelle profylaktiske tiltak mot kaseøs lymfadenitt ble kort drøftet.

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