Norwegian School of Veterinary Science

Nofima marin

BioForsk

The effect of lamb age to a natural A. phagocytophilum infection

Lise Grøva

Ticks (*Ixodes ricinus*)…

Photo Lise Grøva

Photos Lise Grøva

...feed
on
sheep...

… and may transfer disease.

Photo Lise Grøva

General background

- Losses and welfare challenges for grazing sheep in Norway:
  - Blow-flies
  - Alveld (photosensitivity disease related to grazing *Narthecium ossifragum (L.)*)
  - Predators
  - **Tick-borne fever (TBF) (Norwegian: sjodogg)**

- TBF is caused by the bacteria *Anaplasma phagocytophilum* transmitted by the tick (*Ixodes ricinus*)

- Clinics: high fever **+ may cause abortion and sterile rams**
- **Immunosuppression - secondary infections**

General background

- Lower live weights : - 3,8 kg
- High losses of lambs: > 30%
- Estimated that 300 000 **lambs** are infected every year

- The occurrence of ticks seems to increase and spread (Jore et al., 2011) : climate change, bush encroachment, increased number of deer…

- Preventive measures: acaricides (pour-on), clearing bush, drain wet areas, remove hosts and early infection on lambs
  - Risk of ticks becoming resistant to acaricides

Hypotheis

There is an effect of age of lambs on lamb performance when exposed to *A. phagocytophilum* infection

Photo Kari Grøva

Objective and specific background of study

- **Objective:**

To reveal effects on lamb performance of turning ≤ 1 week old lambs onto tick infested pasture compared to turning lambs ≥ 3 weeks old onto tick infested pastures.

- **Background:**

Infection studies have shown that the clinical response to TBF is less severe in young lambs compared with older lambs (Stuen et al., 1992; Stuen, 1993; Stuen and Bergstrom, 2001a).

M&M

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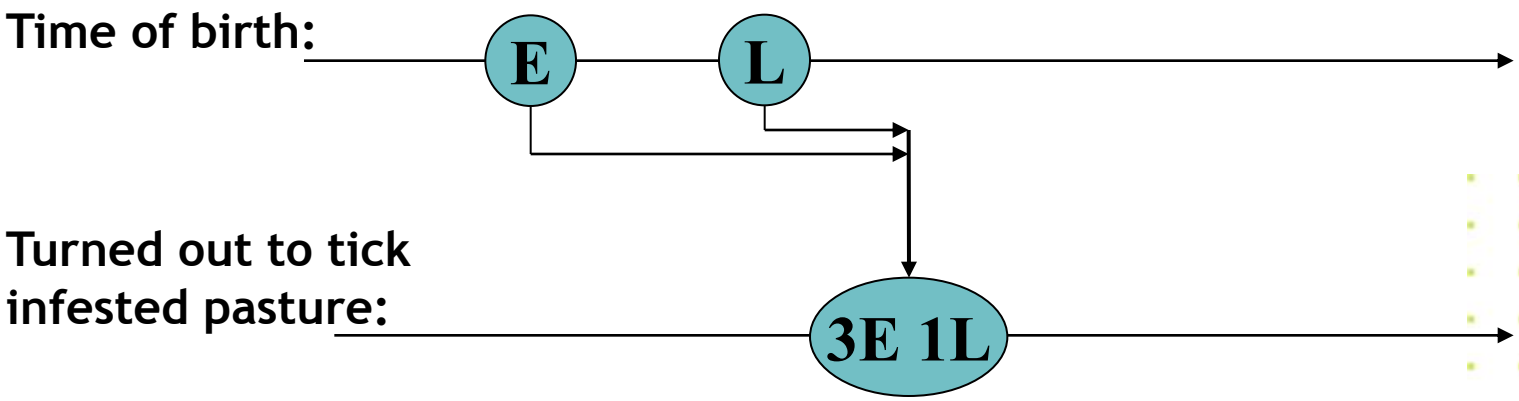
  - 3E: lambs ≥ 3 weeks old when turned out to pasture and early time of birth
  - 1L: lambs ≤ 1 week old when turned out to pasture and late time of birth



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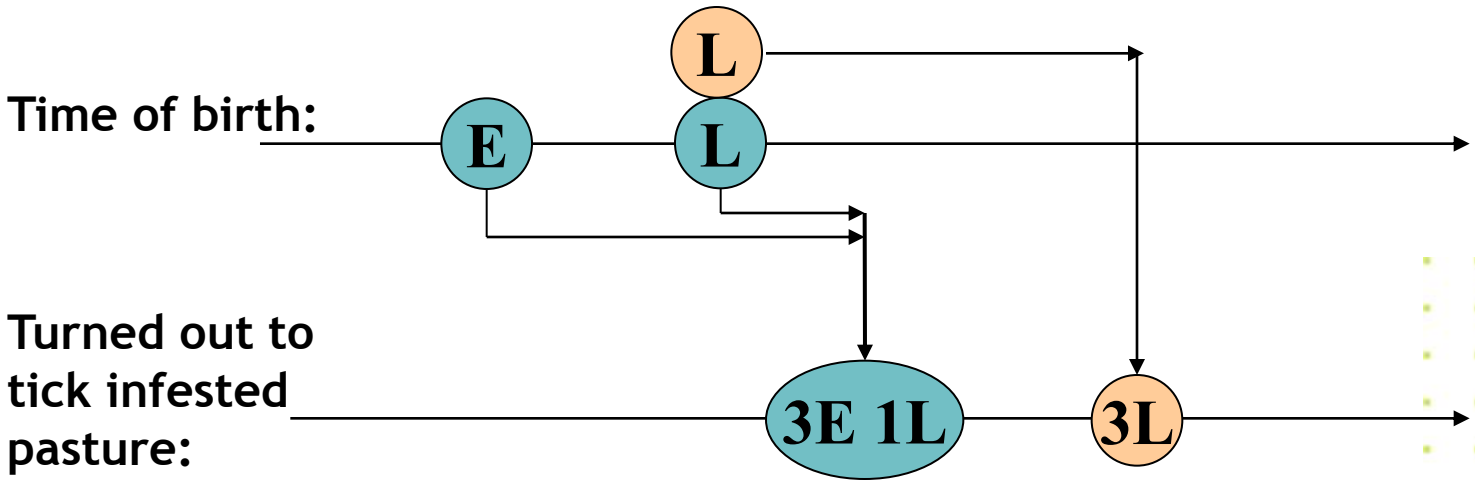

M&M

- **Data:**

  Blood serology, blood smears, recordings of weight, rectal temperature, tick-bites, clinical signs of disease, mortality

- **Acaricides were not used**
- **Disease was treated**

- **Determination of spring infection:**
  - Serology of blood sample in spring ≥ titer 2.8
  - Temperature during spring grazing period ≥ 40.5°C and positive blood smear

Estimate weight curves of lambs by Gompertz function:

$$BW_t = Ae^{\{-e[Be(C-t)/A]\}}$$

BW = body weight, kg;
A = estimated final body weight (BW), kg;
B = maximum average daily gain, kg/day;
C = age at maximum average daily gain, days;
t is the age in days
e is Euler's Number (e=2.71828)

Gompertz weight curve parameters were used to compare weight gain of the three different trial groups.

M&M statistics

- **Performance / weight parameters:**

  Proc MIXED in SAS program

  performance =

fixed effects:	trial group, age at recording of weaning weight and sex
random effects:	farm*year

- **Incidence of fever, clinical disease, tick-bites and mortality between trial groups, farms and years:**

  Proc LOGISTIC in SAS program

Results of incidences

In all three trial groups, in both years and on both farms there were incidences of:

tick-bites

sping infection

fever

other clinical signs of disease

mortality

Incidence tick-bites

tick-bites

Factor	Level	Incidence (%)	Odds Ratio (95%CI)	P-value
trial group	3E	*80.2a*	*1.9 (1.0, 3.5)*	*0.037*
	1L	*86.4a*	*3.0 (1.5, 5.9)*	*0.002*
	3L	*67.3b*	*1.0*	-
year	2008	*92.7*	*8.8 (4.3, 18.0)*	*<0.001*
	2009	*63.4*	*1.0*	-
farm	Farm A	*79.2*	*1.1 (0.7,1.9)*	*0.636*
	Farm B	*76.1*	*1.0*	-

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Incidence of spring infection

spring infection

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trial group	3E	*0.586a*	*3.1 (1.8, 5.4)*	*<0.001*
	1L	*0.527a*	*2.5 (1.4, 4.3)*	*0.001*
	3L	*0.312b*	*1*	-
year	2008	*0.620*	*3.1 (2.0, 4.9)*	*<0.001*
	2009	*0.343*	*1*	-
farm	Farm A	*0.490*	*1.1 (0.7, 1.7)*	*0.664*
	Farm B	*0.465*	*1*	-

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fever

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trial group	3E	*27.6a*	*2.6 (1.3, 5.2)*	*0.007*
	1L	*20.9ab*	*1.8 (0.9, 3.7)*	*0.114*
	3L	*12.7b*	*1.0*	-
year	2008	*26.1*	*2.0 (1.2, 3.5)*	*0.012*
	2009	*15.1*	*1.0*	-
farm	Farm A	*17.4*	*0.7 (0.4, 1.1)*	*0.127*
	Farm B	*23.9*	*1.0*	-

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Incidence of other clinical signs of disease

other clinical signs of disease

Factor	Level	Incidence (%)	Odds Ratio (95%CI)	P-value
trial group	3E	*17.2a*	*1.9 (0.8, 4.1)*	*0.124*
	1L	*10.9a*	*1.1 (0.5, 2.6)*	*0.844*
	3L	*9.1a*	*1.0*	-
year	2008	*21.8*	*8.6 (3.4, 21.7)**	*<0.001*
	2009	*4.1*	*1.0*	-
farm	Farm A	*3.4*	*0.1 (0.0, 0.3)*	*<0.001*
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Incidences summer mortality

summer mortality

Factor	Level	Incidence (%)	Odds Ratio (95%CI)	P-value
trial group	3E	*4.3a*	*0.9 (0.3. 3.3)*	*0.919*
	1L	*5.5a*	*1.2 (0.4, 4.0)*	*0.781*
	3L	*4.5a*	*1.0*	-
year	2008	*3.6*	*0.6 (0.2, 1.7)*	*0.365*
	2009	*5.8*	*1.0*	-
farm	Farm A	*1.1*	*0.1 (0.0, 0.5)*	*0.005*
	Farm B	*8.8*	*1.0*	-

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summer mortality

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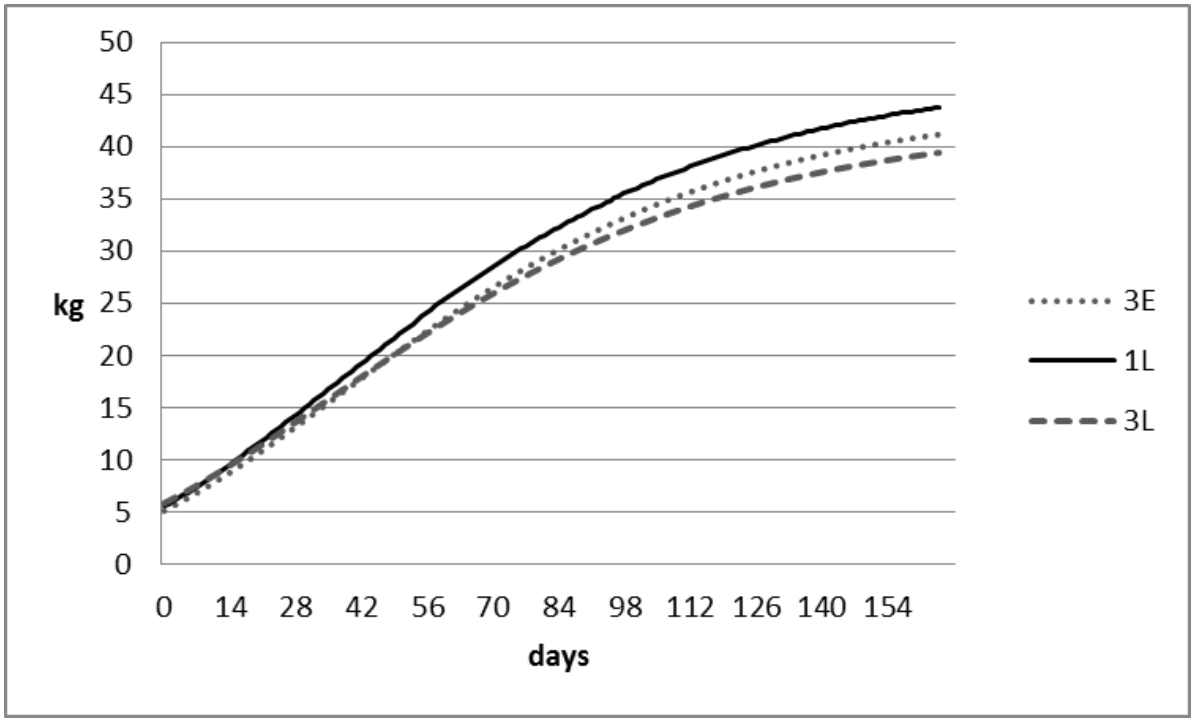
	1L	*5.5a*	*1.2 (0.4, 4.0)*	*0.781*
	3L	*4.5a*	*1.0*	-
year	2008	*3.6*	*0.6 (0.2, 1.7)*	*0.365*
	2009	*5.8*	*1.0*	-
farm	Farm A	*1.1*	*0.1 (0.0, 0.5)*	*0.005*
	Farm B	*8.8*	*1.0*	-

Results of performance

The growth performance of infected lambs in the 1L group was significantly higher:



Conclusions

- ≤ 1 week old lambs infected with *A.ph*. not completely protected against TBF.
- ≤ 1 week old lambs infected with *A.ph*. experience a positive effect on weight gain
- Pasturing lambs shortly after birth can therefore be recommended as a preventive measure to reduce losses to TBF in tick endemic areas.
- However, annual and seasonal variations in tick activity and different variants of *A. phagocytophilum* will likely influence the effect

Resources in the project

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Thank you