Effects of maternal selenium supply during late gestation on colostrum quality and passive transfer of immunity in neonatal lambs

Fabien Corbière [1,2], Jean-Marc Gautier [1,3], Laurence Sagot [3,4]

1 - UMT Santé des Troupeaux de Petits Ruminants, Toulouse, France
2 - National Veterinary School of Toulouse, France
3 - Institut de l'Elevage, Castanet Tolosan, France
4 - CIIRPO, Le Mourier, St Priest Ligoure, France

Introduction

- Colostrum production in ewes
  - Major source of neonatal immunity and energy
  - A key for lamb mortality control

- Numerous factors of variation of colostrum production
  - Udder health
  - Age
  - Litter size
  - Genetic
  - Nutrition (energy and proteins supply, minerals)
  - …

Introduction

- Supra-nutritional Se supply in late gestation (80 µg/kg BW)
  - Control : adequate supply (~ 10 µg/kg BW) in non deficient ewes
  - No effect or increase of colostrum yield (Swanson et al., 2008 ; Meyer et al., 2011)
  - No effect on IgG1 concentration (Swanson et al., 2008 ; Rock 2001)
  - Effect on passive transfer of immunity : conflicting reports (Hammer et al., 2011 ; Boland et al 2005 ; Lacetera et al. 1996, 1999, Rock 2001)

- Se adequate supply in deficient ewes in late gestation
  - Colostrum yield: ?
  - IgG1 concentration: ?
  - Effect on passive immunity transfer: ?

Aims

- To investigate effects of Selenium supply during late gestation on moderately deficient ewes

  - on colostrum quality
  - on passive transfer of immunity in neonatal lambs
  - on lambs performances

Material and methods

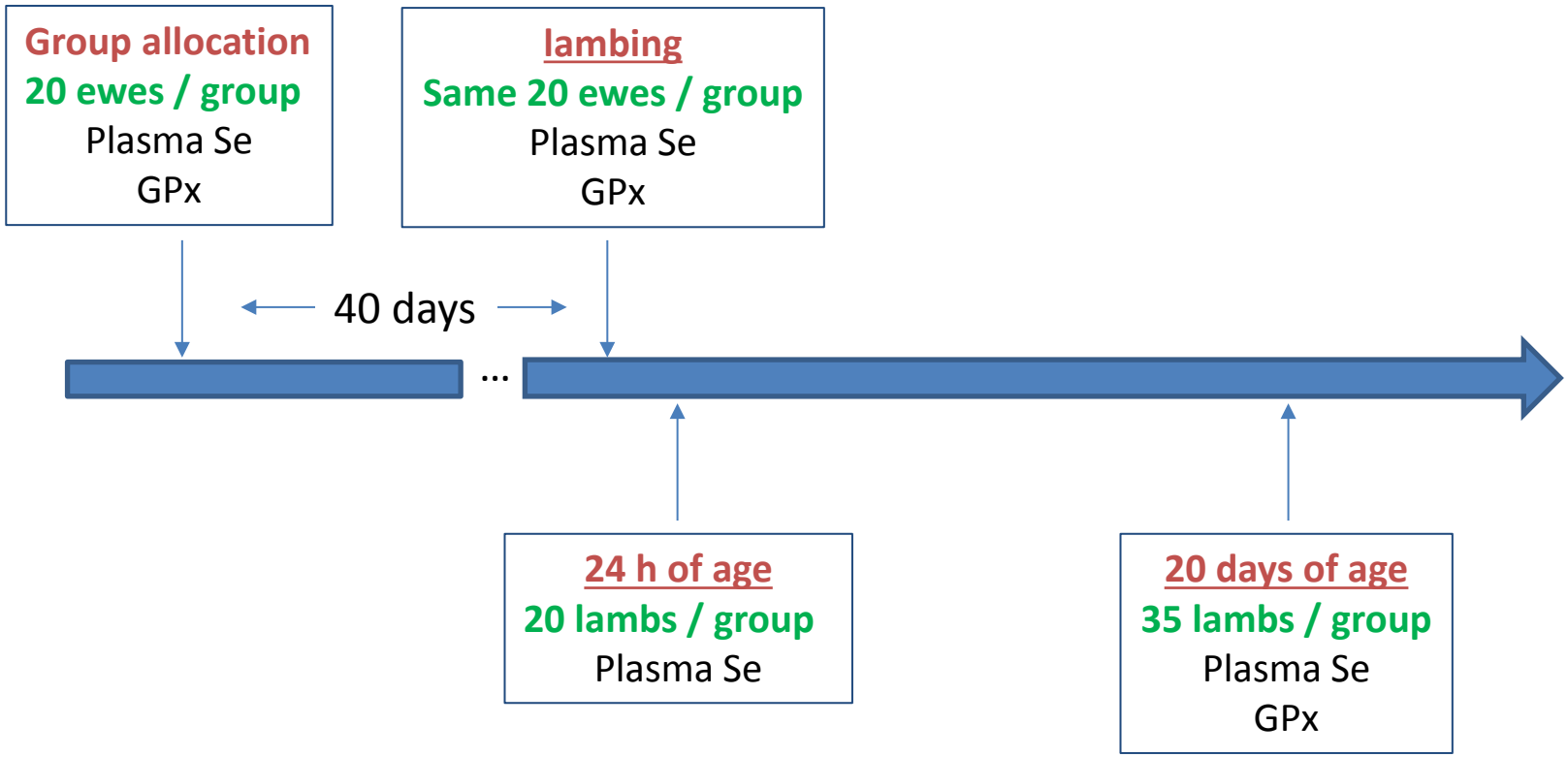
- 80 Vendéen ewes, allocated in two groups
  - Same age (3.3 ± 0.28 years)
  - Same litter size (1.77 ± 0.08)
  - Same body score condition
    - allocation (3.5 ± 0.1) ; lambing (3.0 ± 0.1)

- Daily regimen during the last five weeks of gestation
  - Both groups : grass + triticale (5 w, 200g /d) + rape oil cake (2 w, 100 g/d)
  - Se group : mineral preparation : 40 g /d
    - Sodium selinite (28 mk/kg) + selenium yeast* (6 mg/kg)
    - Se daily total intake : 15 µg/kg BW = 0.5 ppm DM
  - Control group : same preparation without Se
    - Se daily total intake : 1.5 µg/kg BW = 0.06 ppm DM = low level

**Saccharomyces cerevisae, Sel-plex®*

Material and methods

- Selenium status assessment



GPx : erythrocyte glutathione peroxidase activity

Material and methods

- Assessment of colostrum quality
  - 25 ewes / group
  - Colostrum milking at lambing (before any sucking)
  - IgG1 concentration : SRID (IDRing Sheep IgG, IDBiotech)
  - Butterfat concentration : Gerber method

- Assessment of passive transfert of immunity
  - 30 lambs / group
  - 24 hours of age
  - IgG1 concentration : SRID (IDRing Sheep IgG, IDBiotech)

Material and methods

- Other records
  - Lambing ease
  - Udder health
  - Lamb weight
    - At birth
    - At weaning
    - At slauthering
  - Lamb diseases and deaths (necropsy)

Results : Se status in ewes

- Se status in ewes at group allocation and lambing

Time point	Variable	Control group (n=20)	Se Group (n=20)	p value*
At group allocation	Se (*µg/l*)	**27.2** ± 1.3	**25.2** ± 1.5	0.45
	GPX (UI/ml)	**60.2** ± 3.2	**63.1** ± 3.5	0.52
At lambing	Se (*µg/l*)	**79.6** ± 5.4	**169.6** ± 5.8	$<10^{-4}$
	GPX (UI/ml)	**71.7** ± 4.0	**421.9** ± 28.1	$<10^{-4}$

*Adjusted on dam's age, BCS and litter size

➔Strong effect on ewes Se status

Results : Se status in lambs

- Se status in lambs à 24 hours (n=20) and 20 days of age (n=35)

Age	Variable	Control group	Se group	p value*
24 hours	Se (*µg/l*)	**27.8** ± 1.3	**70.6** ± 3.9	$<10^{-4}$
20 days	Se (*µg/l*)	**62.7**± 1.9	**80.7** ± 1.7	$<10^{-4}$
	GPX (UI/ml)	**317.9** ± 19.9	**791,7** ± 28.6	$<10^{-4}$

*Adjusted on dam's age and BCS, litter size, lamb sex, birth weight

➔Strong effect on lamb Se status

Results : colostrum quality

- Colostrum IgG1 and Butterfat concentrations at lambing

Variable	Control group (n=24)	Se group (n=25)	p value*
IgG1 (*g/l*)	**91.4** ± 6.0	**92.5** ± 7.6	0.80
% < 50 g/l IgG1	4.2	16.0	0.35
BT (g/l)	**87.3** ± 7.2	**79.8** ± 6.5	0.94

*Adjusted on dam's age, BCS and litter size

➔No effect of Se supply on colostrum IgG1 and Butterfat concentrations

Results : PTI in lambs

- Plasma IgG1 concentration in lambs at 24 h of age

Variable	Control group (n=35)	Se group (n=35)	p value*
IgG1 (*g/l*)	**25.8** ± 1.7	**26.8** ± 1. 2	0.67
% < 10 g/l IgG1	0	0	-
% < 15 g/l IgG1	3.4	3.4	1.0

*Adjusted on dam's age and BCS, litter size, sex, birth weight

➔No effect of Se supply on lambs plasma IgG1 concentrations

Results : lambs performances

- Lambs weight
  - Birth weight: no effect (p=0.61*)
  - Daily weight gain
    - Between birth and 30 days: Se group / control group: - 19.2 g (p=0.054*)
    - Between birth and weaning at 70 days : no effect (p=0.39*)
    - Between birth and slauthering at 150 days: no effect (p= 0.29*)

- Mortality records

	Control group	Se group	p value*
Abortion and stillbirth (%)	2.9	7.6	0.26
Death birth to weaning (%)	3.7	3.5	0.95
Death after weaning (%)	5.6	5.3	0.94

*Adjusted on dam's age and BCS , litter size, lamb sex and birth weight

Discussion / conclusion

- Effect of Se supply during last gestation
  - No effect
    - On colostrum IgG1 / BT concentration
    - On passive transfer of immunity
    - On lambs' performances

- Material and methods : limits
  - Moderate Se deficiency
    - Effect in highly deficient ewes ?
  - No evaluation of colostrum yield

Discussion / conclusion

- Effect of Se supply during last gestation
  - Highly efficient
    - To restore Se status in dams
    - To provide lambs with satisfactory Se status at birth

Acknowledgements

Financial support

FranceAgriMer

Alltech ...naturellement

MSD Vivre mieux

Technical support

- Charlotte Meissonnier
- Christele Piau

Acknowledgements

Financial support

FranceAgriMer

Alltech ...naturellement

MSD Vivre mieux

Technical support

- Charlotte Meissonnier
- Christele Piau

Thank you for your attention

Le CIIRPO