EFFECT OF DIETARY VITAMIN E ON TRANS FATTY ACID PROFILE OF MUSCLE AND ADIPOSE TISSUES OF INDOOR LAMBS

V. Berthelot, L. Broudiscou, P. Schmidely

UMR MoSAR INRA-AgroParisTech,
Paris, France

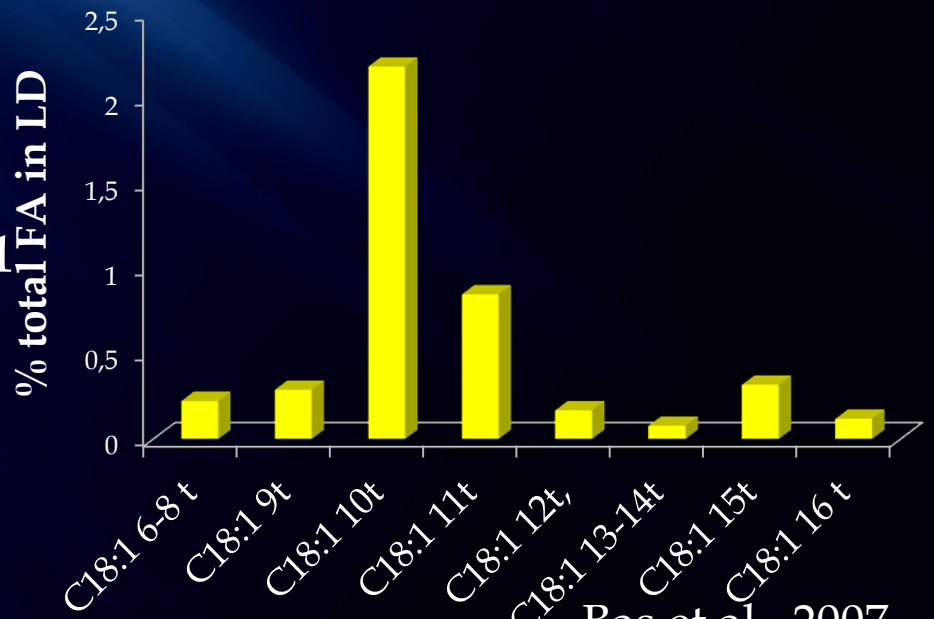
Context (1)

- To improve meat nutritional quality from ruminant producers need to focus on
  - Lipid content
  - PUFA and specially n-3 LC-PUFA content
  - Limitation of **trans-FA** (other than C18:1 11t), specially **C18:1 10t**

precursor of C18:2 9c, 11t ☺

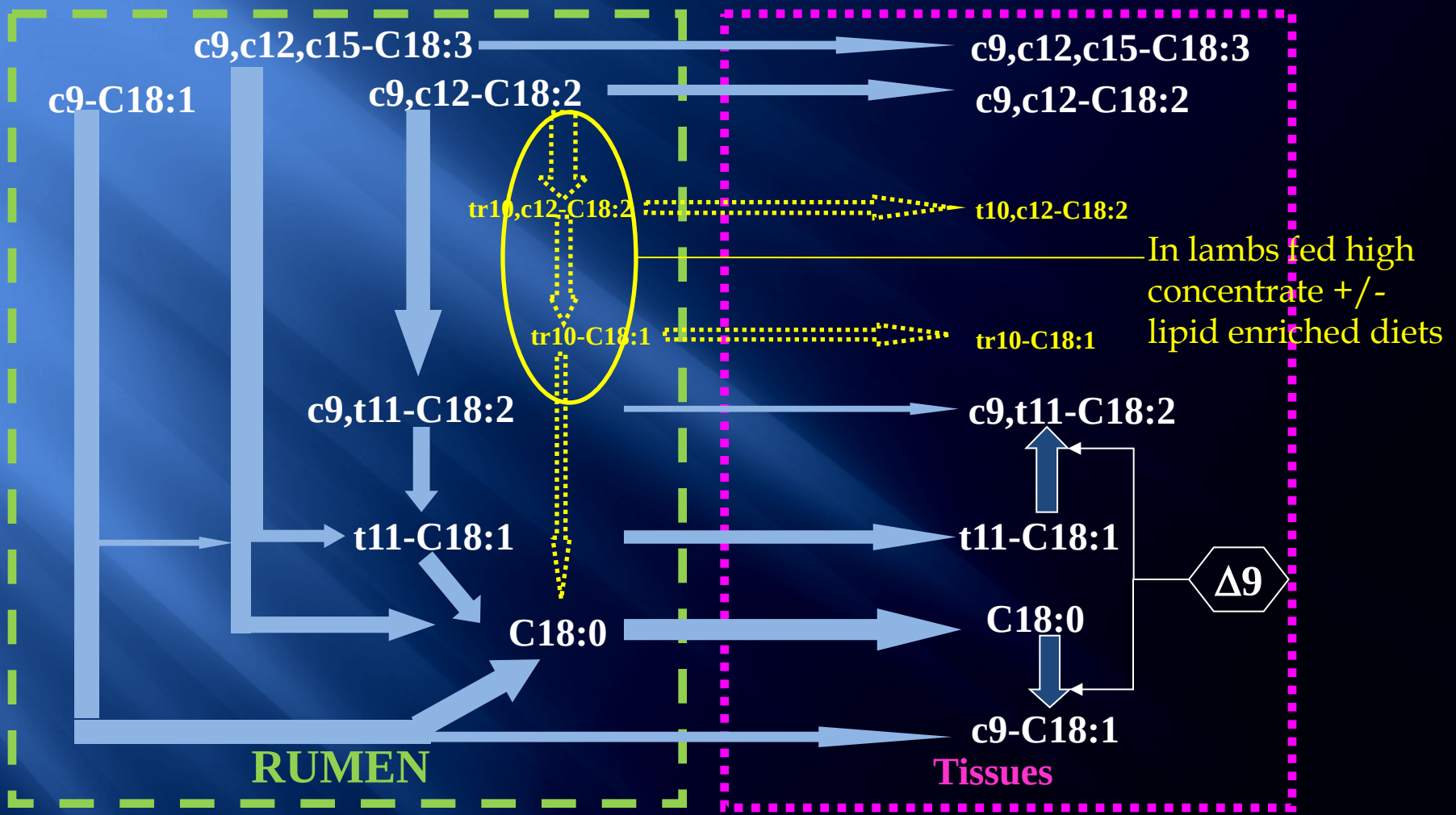
associated to coronary heart disease in human ☹

- Lambs fed high concentrate diets +/- supplemented with lipids
  - **High** proportion of **trans C18:1**
  - Mainly **C18:1 10t** vs C18:1 11t profile



Bas et al., 2007

Ruminal biohydrogenation of PUFA and metabolic pathways of some FA synthesis



with diets rich in concentrate and/or in PUFA

In normal conditions of FA biohydrogenation

Δ9: Stearoyl-CoA desaturase activity in tissue

Context (2)

- Vitamin E (α-tocopherol) =
  - Essential vitamin required for animals
  - Lipophilic antioxidant used to prevent discoloration and oxidation rancidity during storage in meat

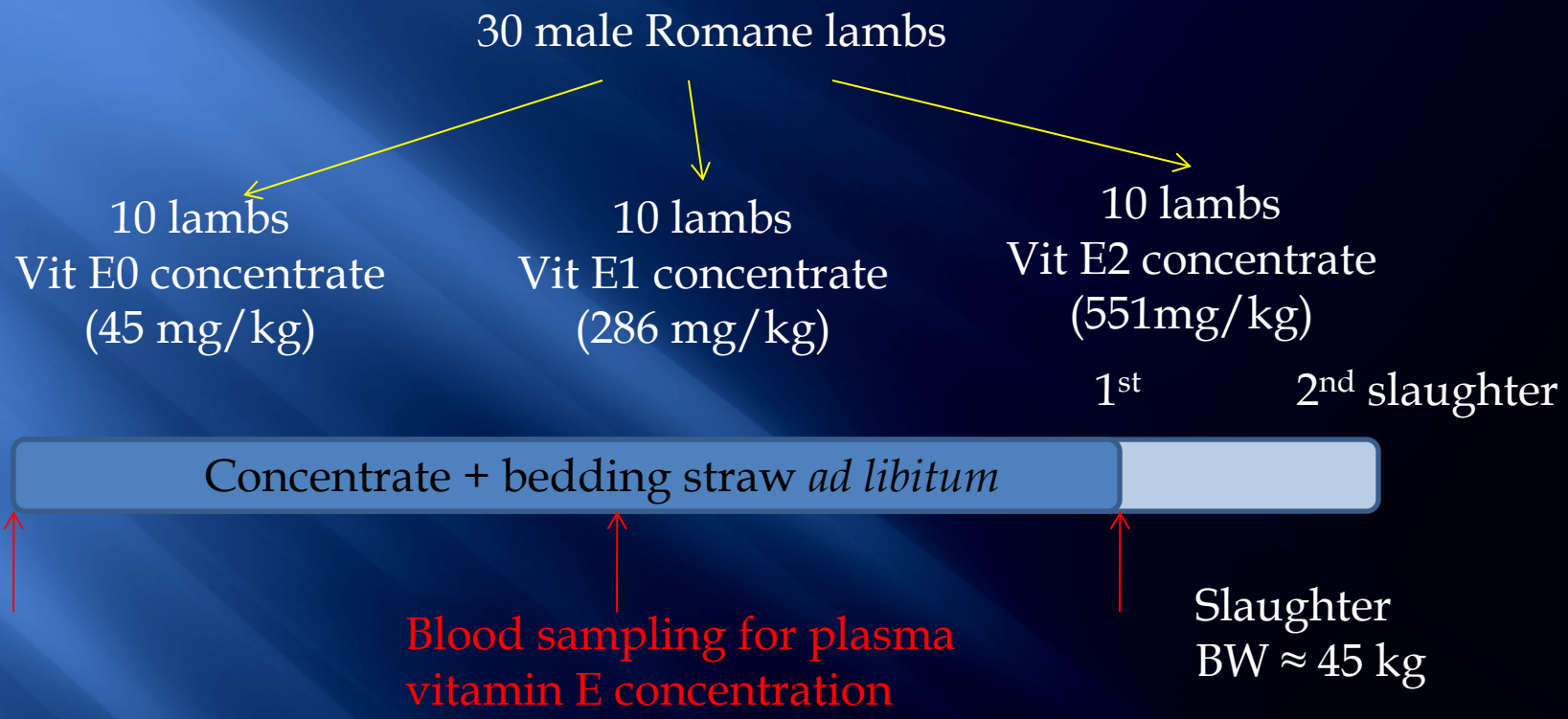
- In steers fed barley, vitamin E supplementation (from 30 to 170mg/kg DM)
  - Decreased proportion of total trans C18:1 in muscle and adipose tissues (Juarez et al., 2011)
  - Decreased C18:1 10t proportion associated to an increase or not in the C18:1 11t proportion in muscle or adipose tissues (Juarez et al., 2010; Mapiye et al., 2012)

Vitamin E = a way to prevent the 11t to 10t shift during biohydrogenation of PUFA in the rumen ?

Aim of the study

Investigate the effect of dietary vitamin E supplementation on trans fatty acid profile of muscle and adipose tissues of lambs fed high concentrate diet supplemented with lipids

Material and methods



Measurement

Each week : Concentrate intake
Lamb body weight

At slaughter : Muscle (*extensior carpi radialis*)
Perirenal adipose tissue
Caudal adipose tissue

} FA determination by GC

Feed and chemical composition of the concentrates

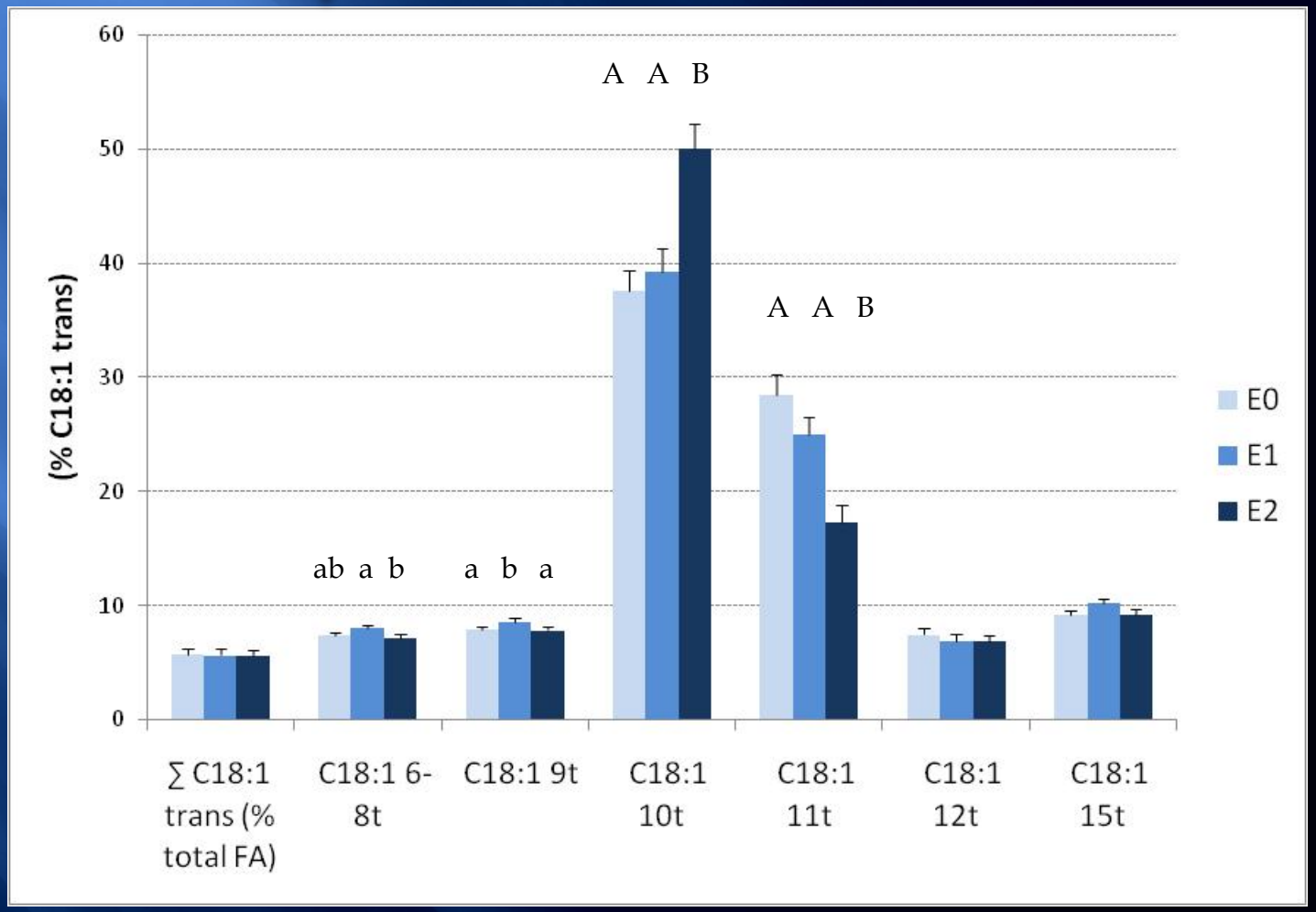
	E0	E1	E2
Concentrate composition (%)			
Dehydrated alfalfa	24	23.6	23.15
Wheat	44	44	44
High fat rapeseed meal	24	24	24
Molasses	6	6	6
Mineral and Vitamin mix	2	2.4	2.85
Chemical composition (% DM)			
OM	90.9	90.9	90.3
NDF	25.3	23.1	24.0
Crude protein	19.9	19.8	19.8
Total Fatty Acid	4.6	4.7	4.5
Fatty acid (g 100g FA^{-1})			
C16:0	11.0	10.7	10.7
C18:0	2.1	1.9	1.9
C18:1 n-9	42.1	41.4	41.7
C18:2 n-6	28.4	29.6	29.1
C18:3 n-3	8.0	8.4	8.1
dl-α-tocopheryl acetate (mg kg^{-1})	45	286	551

Lamb performance and slaughter parameters

Item	E0	E1	E2	SEM	P
number of lambs	10	10	9		
Initial liveweight (kg)	29.4	28.9	30.2	0.48	0.56
Liveweight at slaughter (kg)	46.7[ab]	44.9[a]	47.2[b]	0.42	0.05
Age at slaughter (d)	132	132	131	1.5	0.93
ADG (g/d)	385	358	389	8.3	0.26
Cold carcass weight (kg)	20.6	19.7	20.6	0.22	0.15
Killing out percentage (%)	44.1	43.9	43.5	0.20	0.50
Conformation score [1]	8.1	7.7	8.2	0.11	0.13
Fatness score [2]	7.7	7.7	7.3	0.20	0.70

[1] 15 points conformation scale (P^-=1 to E^+=15)
[2] 15 points fatness scale (1^-=1 to 5^+=15)

Effect of dietary vitamin E supplementation on the C18:1 trans profile of tissues



(a, b): P<0.05
(A, B) P<0.0001

Discussion

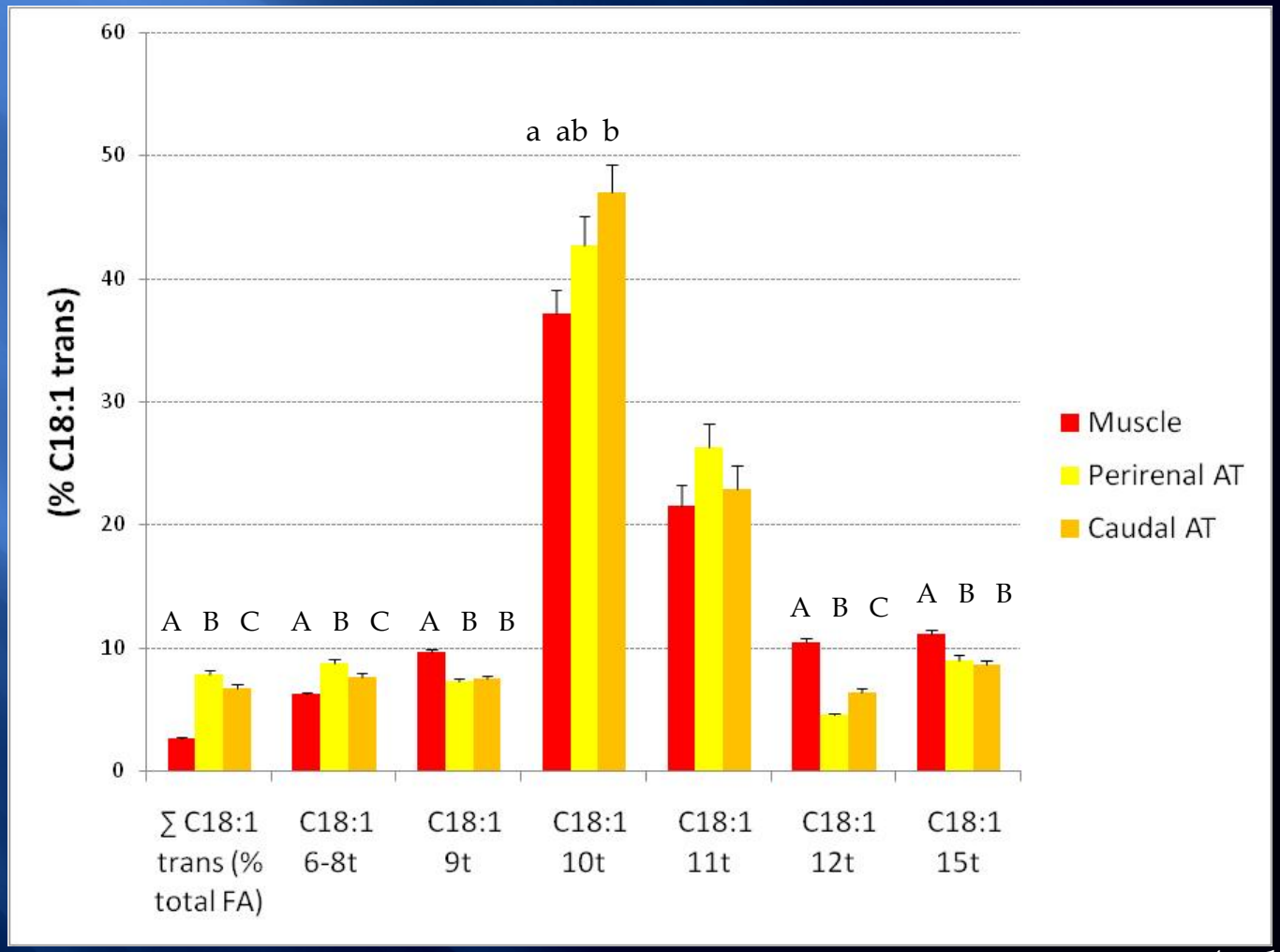
- Contrary to dietary vitamin E supplementation of steers fed high concentrate diets (Juarez et al., 2010 and 2011 Malpiye at al., 2012)
  - No decrease in the proportion of ∑C18:1 trans
  - No prevention of the C18:1 10t shift
- Hypotheses :
  - Physicochemical conditions (pH, Eh) and the microbial community composition in lambs rumen compared to steers might be different enough to qualitatively change the action of vitamin E
  - The 10t shift might have already occured in lambs as it was shown that vitamin E supplementation in dairy cows was unable to restore the 11t pathway when the 10t-shift had been already settled. (Zened et al., 2012)

Conclusion

- Dietary vitamin E supplementation
  - Did not modify lamb growth and slaughter parameters
  - Did not decrease the proportion of ∑C18:1 trans
  - Increased the proportion of C18:1 10t and decreased the C18:1 11t (and C18:2 9c,11t) in muscle and adipose tissues of lambs fed the highest level of vitamin E supplementation (500 mg/kg DM)
- Vitamin E supplementation did not improve the C18:1 trans isomeric profile in the meat of lambs fed high concentrate diets. It potentially lowered the lamb meat nutritional value.

Thanks for your attention

C18:1 trans profile in muscle and adipose tissues



(a, b): P<0.001
(A, B) P<0.0001