Fat supplementation and placental transfer of polyunsaturated fatty acids (PUFA) in goats

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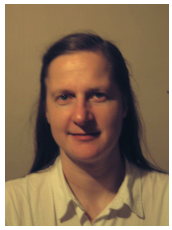


INTRODUCTION

- During foetal development the brain has very high requirements for PUFA
- Ruminants consume very little arachidonic (C20:4n-6) and docosahexaenoic (C22:6n-3) acids
  → supply may be too low for correct brain growth
- C20:4n-6 and C22:6n-3 precursors, linoleic (C18:2n-6) and linolenic (C18:3n-3) acids respectively, may not be absorbed in sufficient quantities due to rumen bio-hydrogenation

OBJECTIVES

To study the effect of the type of fat supplement on PUFA transfer from dam to foetus

MATERIAL AND METHODS

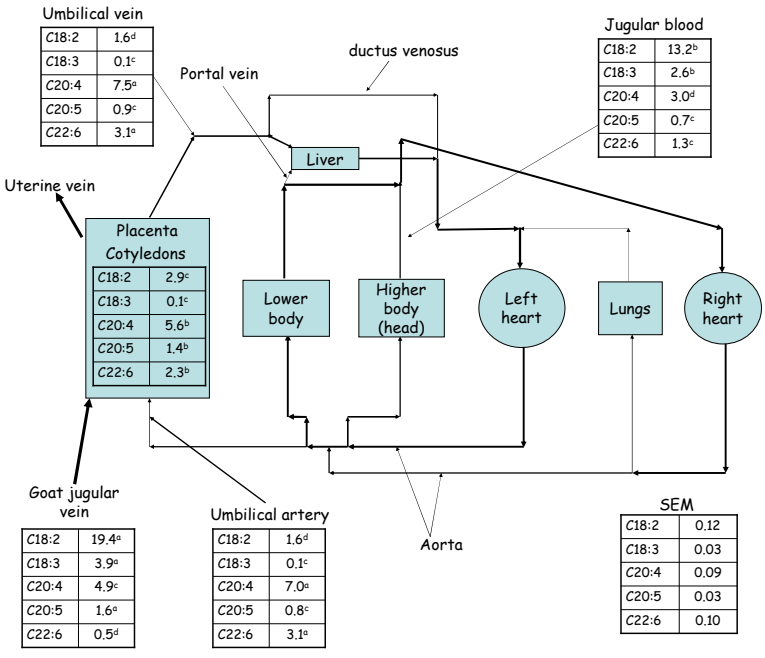
- Animals:
  From 1.5 months pre-term
  - 16 goats received a control diet containing a concentrate rich in rapeseed (rich in C18:1n-9 (oleic acid), 25%; low in C18:3n-3, 5%)
  - 14 goats received a diet containing a concentrate rich in linseed (L, rich in C18:3n-3, 23%; low in C18:1n-9, 7%)
- Sampling at birth:
  - goat and kid jugular plasma
  - cotyledon and umbilical blood
- Analyses:
  Fatty acid profile
  ANOVA

Table 1. Effect of the type of concentrate (rich in rapeseed or linseed) on the fatty acid % at birth in different pools

Fatty acid	Rapeseed (n=16)					Linseed (n=14)						
	GJ[1]	Cot	V	KJ	Art	GJ	Cot	V	KJ	Art	SEM	P
C16:0	14,6 d	16,5 c	16,6 c	17,2 bc	18,0 ab	14,1 d	16,4 c	17,4 bc	17,2 bc	19,1 a	0,45	T***
C16:1	0,5 c	4,1 a	3,5 a	1,4 b	4,0 a	0,5 c	4,0 a	3,5 a	1,6 b	3,8 a	0,31	T***
C18:0	24,1 a	13,3 d	14,9 c	16,5 b	16,3 bc	24,9 a	13,2 d	15,2 bc	16,4 bc	16,8 b	0,70	T***
C18:1n-9	21,7 d	43,1 a	38,6 b	30,0 c	38,1 b	18,5 e	43,2 a	37,9 b	29,5 c	36,7 b	1,19	D+, T***
C18:2n-6	19,4 a	3,0 c	1,9 de	13,5 b	1,7 de	19,4 a	2,8 cd	1,2 e	13,0 b	1,4 e	0,38	T***
C18:3n-6	0,2 c	0,2 bc	0,1 d	0,2 c	0,0 d	0,4 a	0,3 bc	0,0 d	0,3 b	0,0 d	0,04	T**
C18:3n-3	2,8 b	0,1 d	0,2 d	2,2 c	0,1 d	5,0 a	0,2 d	0,1 d	2,9 b	0,1 d	0,14	D**, T***, DxT***
C20:4n-6	5,3 de	5,8 cd	7,9 a	3,1 f	7,4 ab	4,5 e	5,3 de	7,2 ab	2,9 f	6,7 bc	0,39	D**, T***
C20:5n-3	1,2 c	1,1 c	0,6 de	0,5 e	0,7 de	2,0 a	1,6 b	1,2 c	0,9 cd	1,0 cd	0,14	D***, T***
C22:6n-3	0,3 e	1,9 bc	2,9 a	1,2 cd	2,8 a	0,7 de	2,6 ab	3,3 a	1,4 cd	3,4 a	0,39	D*, T***

[1]GJ = goat jugular plasma, Cot = cotyledon, V = umbilical vein, KJ = kid jugular plasma, Art = umbilical artery. For a given line, values with different letters are different; *** : P<0.001, ** : P<0.01, * : P<0.05, + : P<0,1. D = diet effect, T = tissue effect, DxT = diet x tissue interaction.

Figure 1. PUFA proportions (%) in different pools at birth



A fatty acid with different letters indicates differences; P<0.0001

RESULTS

- % of C18:3n-3, C20:5n-3 and C22:6n-3 increased and % C20:4n-6 decreased after the L compared to the control diet (Table 1)
- For both diets the % of C18:2n-6 and C18:3n-3 decreased between the goat jugular and the umbilical vein and the % of C20:4n-6 and C22:6n-3 increased (Figure 1)

CONCLUSION

- Diet effect on FA proportions modest compared to the differences in diet composition, probably due to rumen bio-hydrogenation
- Transfer of C18:3n-3 and C18:2n-6 from dam to foetus appears to be very low while C20:4n-6 and C22:6n-3 appear to be concentrated in the foetus compared to the dam
- There may be either a selective placental transport system for PUFA, or C18:2n-6 and C18:3n-3 may be elongated and desaturated in the placenta to C20:4n-6 and C22:6n-3

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