

Exploring the effect of dietary L-carnitine inclusion on the performance of modern hyper prolific sows and their offspring

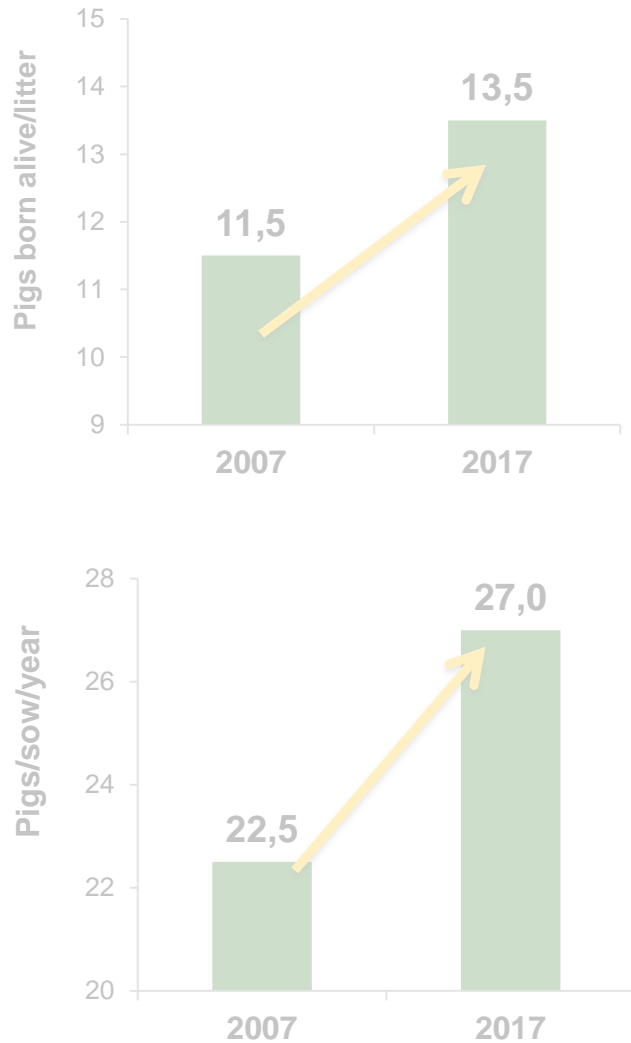
H. Rooney, K. O'Driscoll, J. O'Doherty, P.G. Lawlor

Annual Meeting | EAAP | Dubrovnik | Croatia

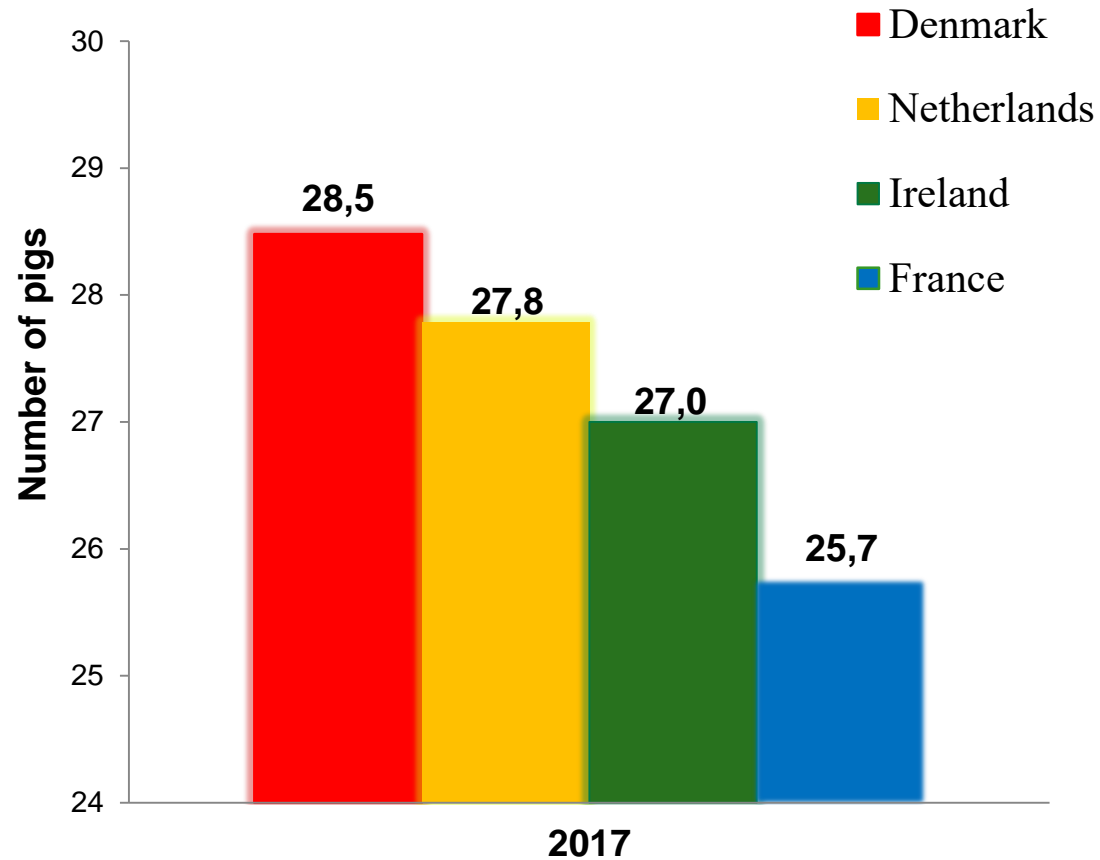


Introduction

Irish swine sector *(Teagasc eProfit Monitor, 2017)*



Pigs sold/sow/year *(Interpig, 2017)*



Introduction



 Litter size does have consequences..

Sows

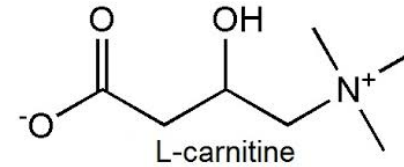
1. High milk demand *(LeDividich, 2007)*
2. Loss of body reserves *(Rutherford et al., 2013)*

Offspring

1. Low birthweight *(Quiniou et al., 2002)*
2. Poor viability *(Herpin et al., 1996)*
3. Increased litter variation *(Quiniou et al., 2002)*
4. Increased mortality *(Stanton & Carroll, 1974; Lund et al., 2002)*



L-Carnitine



AA: Lysine and methionine

Primary role: Regulate transport of fatty acids

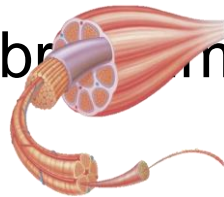
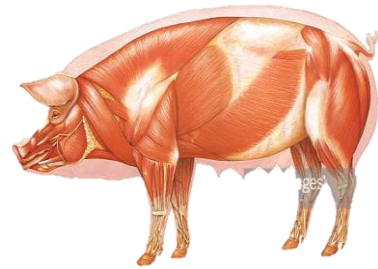


- ✓ Improved sow energy status (Borum et al., 1991, Owen et al., 2001; Birkenfeld et al., 2006)
- ✓ Enhance IGF-1 levels in the sow (Musser et al., 1999; Owen et al., 2001)
- ✓ ↑ Nutritional quality of milk (Ramanau et al., 2004, Ramanau et al., 2005)

L-Carnitine

AA: Lysine and methionine

- ✓ Regulate transport of fatty acids across *(Birkenfeld et al., 2006)*
- ✓ Improved sow energy status *(Borum et al., 1991, Owen et al., 2001; Birkenfeld et al., 2006)*
- ✓ ↑ Milk nutritional quality *(Ramanau et al., (2004), Ramanau et al., (2005)*
- ✓ ↑ Litter size at birth *(Musser et al., 1999, Ramanau et al., 2002, Ramanau et al., 2008)*
- ✓ ↑ Birthweight → ↑ muscle fiber number & size *(Waylan et al., 2005, Reid et al., 2016)*



Objective

L-carnitine supplementation during gestation and/or lactation

- **Sow**

↓ Mobilisation of reserves

- **Offspring**

↑ Numbers born

↑ Lean growth potential

↑ Growth & feed efficiency

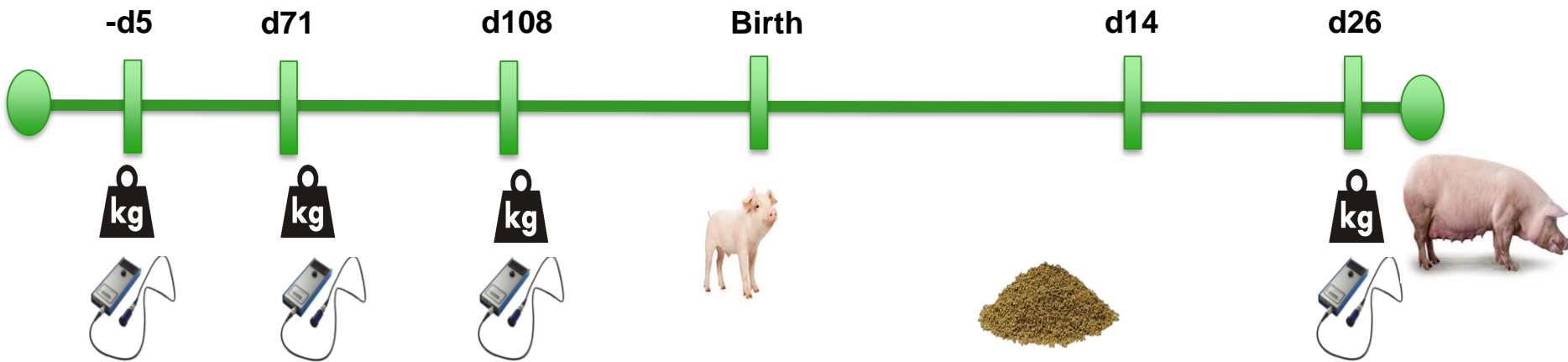




Materials & Methods

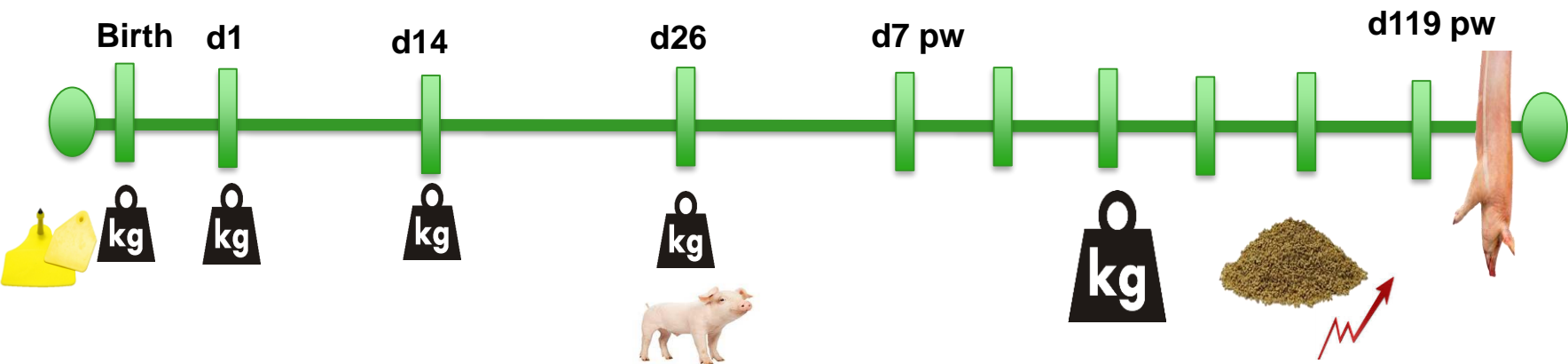
Materials & methods

- 66 sows (~17/treatment)
- Duration: **Day 1 of gestation → Day 26 of lactation**
- Treatments:
 1. Control (0mg/d)
 2. Gestation (125mg L-carnitine/d during gestation)
 3. Lactation (125mg L-carnitine/d during lactation)
 4. Both (125mg L-carnitine/d during gestation & lactation)



Materials & methods

- Sub-sample followed to slaughter → FIRE feeders
- Treatments:
 1. Control (0mg/d)
 2. Gestation (125mg L-carnitine/d during gestation)
 3. Lactation (125mg L-carnitine/d during lactation)
 4. Both (125mg L-carnitine/d during gestation & lactation)



Materials & methods

- Muscle sampling → Semitendinosus muscle

Birth



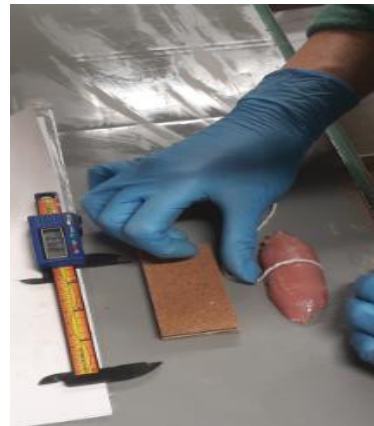
Sample size at each sampling:
48 → 24M & 24F

96 pigs

Weaning



- Measures:
 1. Weight
 2. Length
 3. Girth
 4. Fibre typing





Results



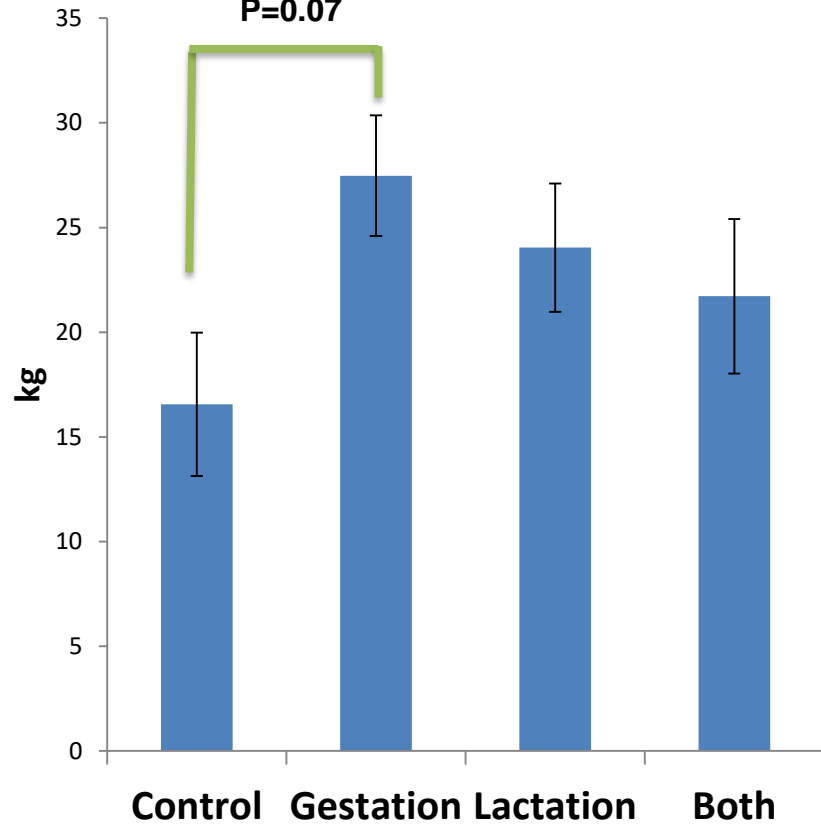
Sow Performance

Loss of maternal body reserves

Sow Weight Loss

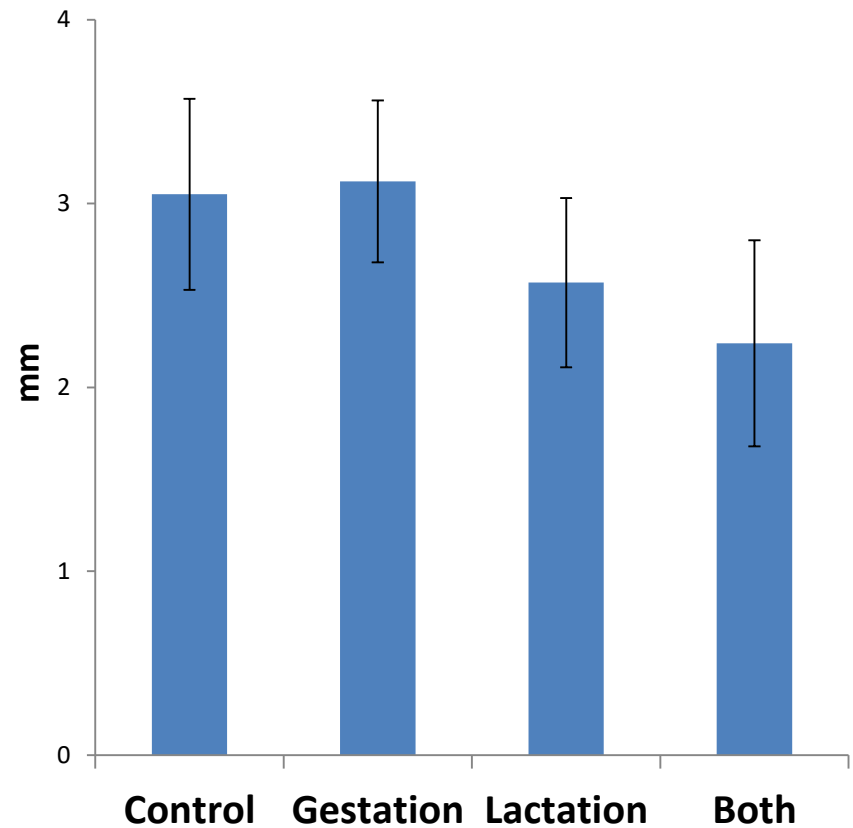
P=0.04

P=0.07



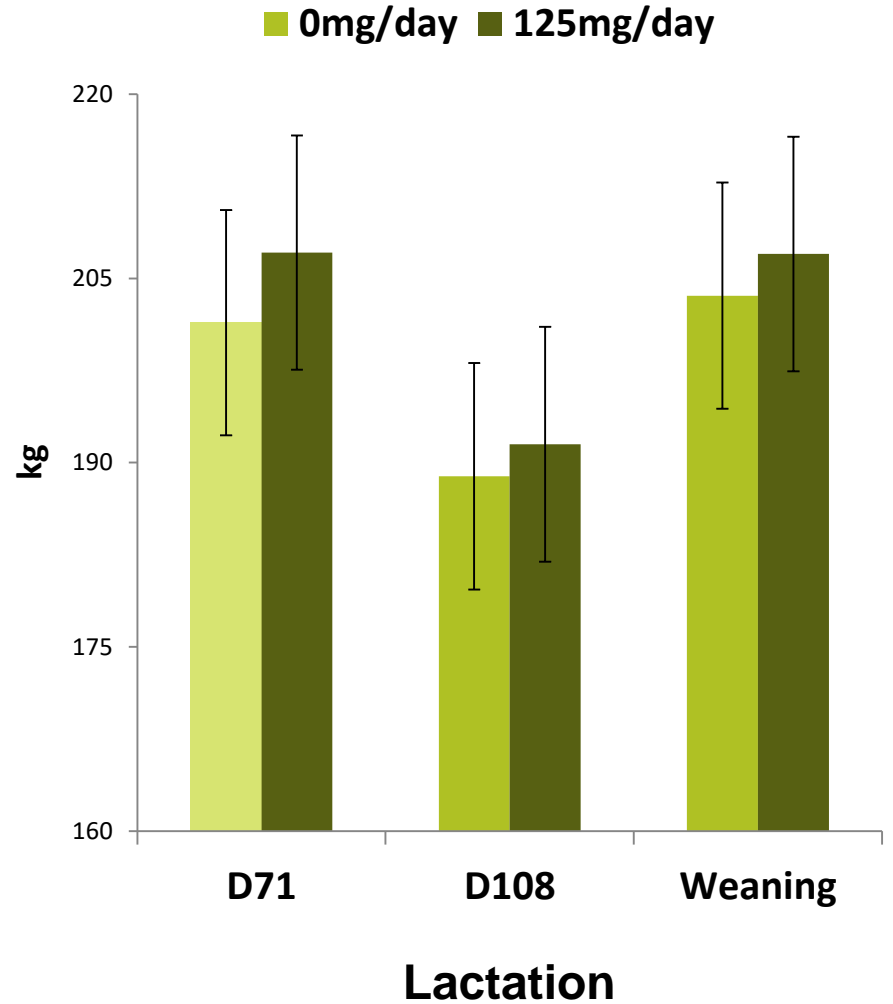
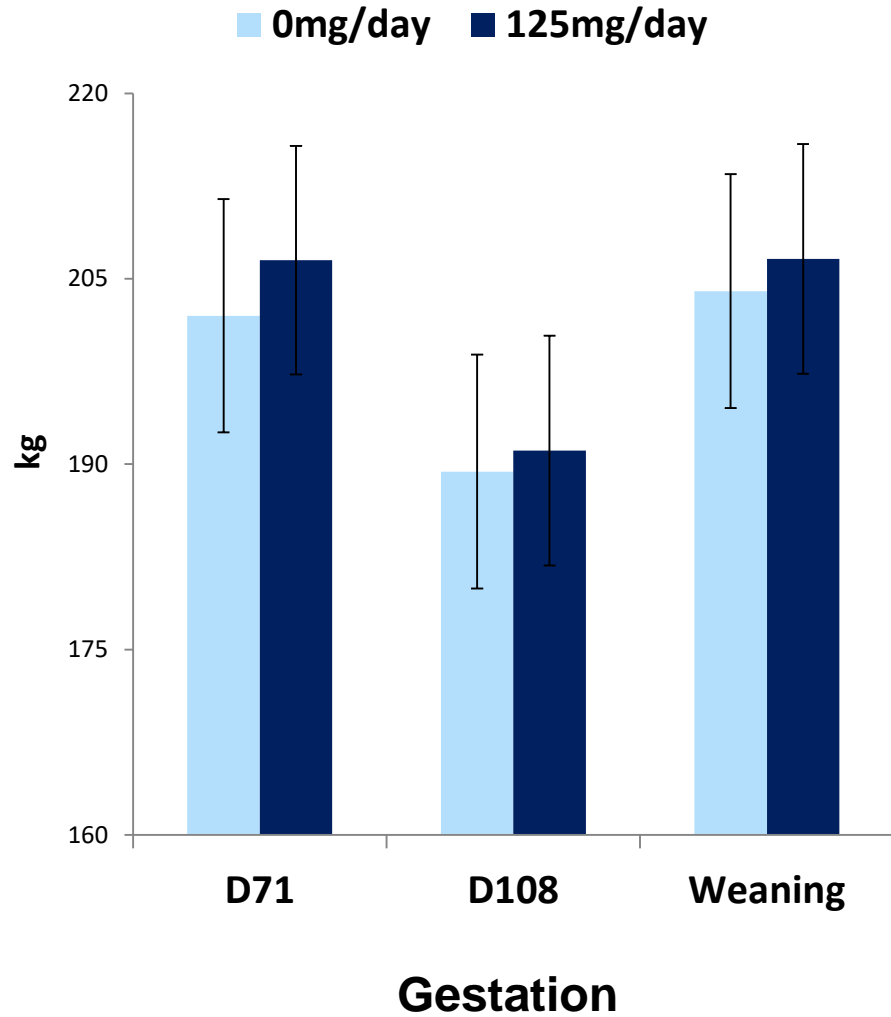
D108 to Weaning

Sow Back fat Loss

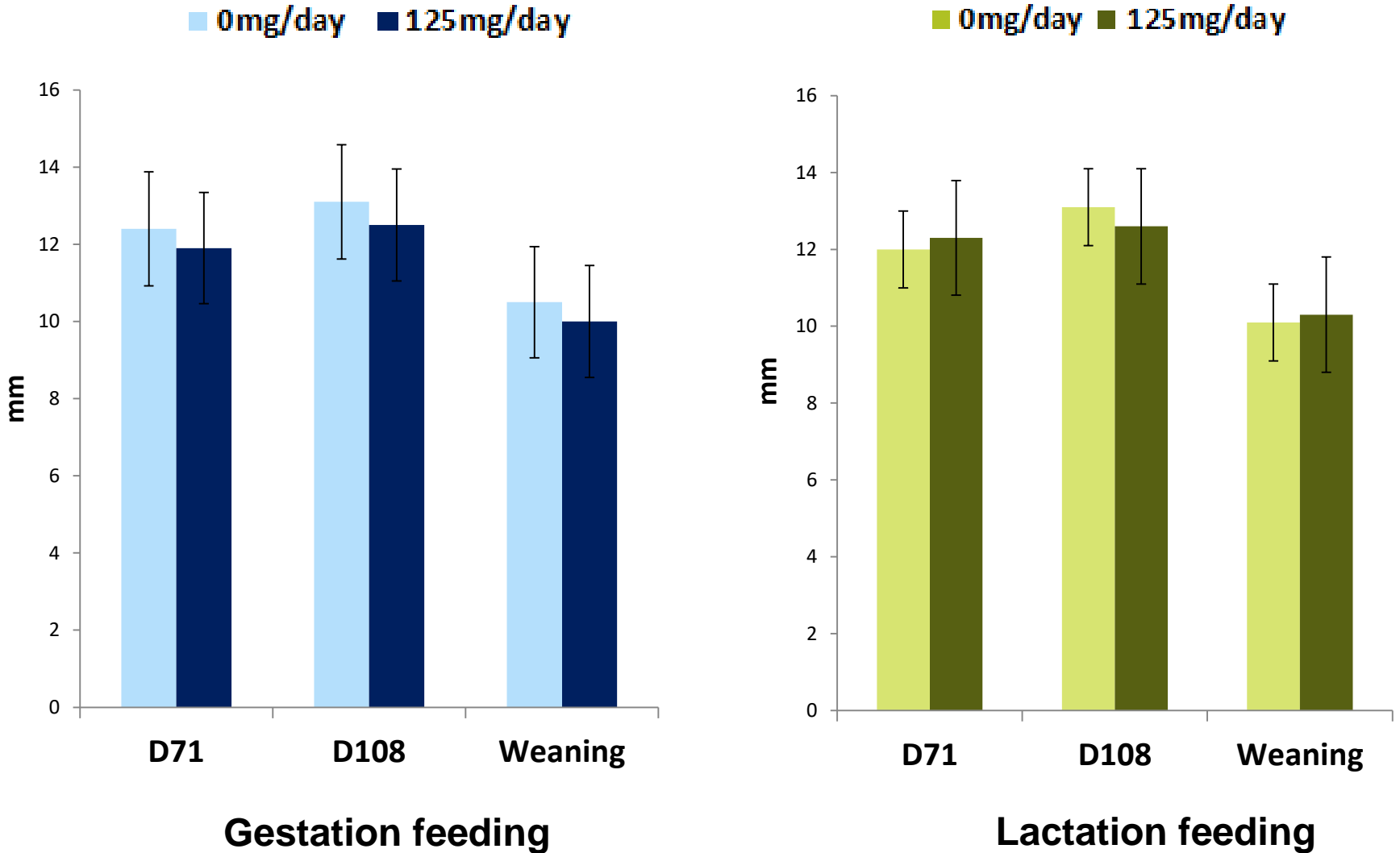


D108 to Weaning

Main effects: Sow weight



Main effects: Sow back fat depth

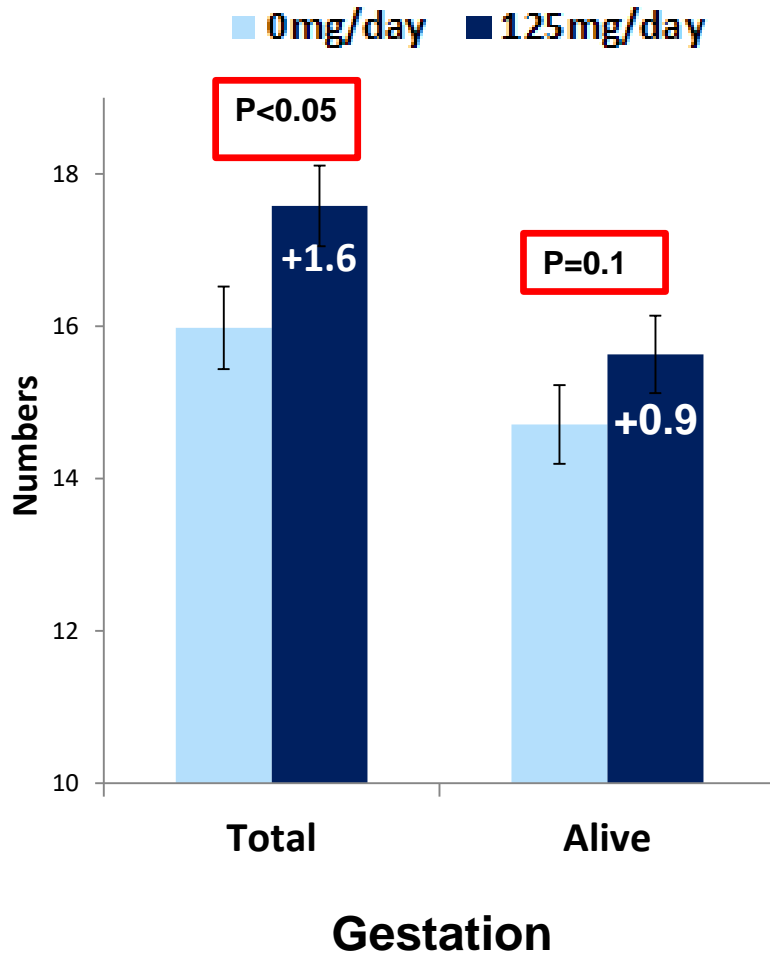




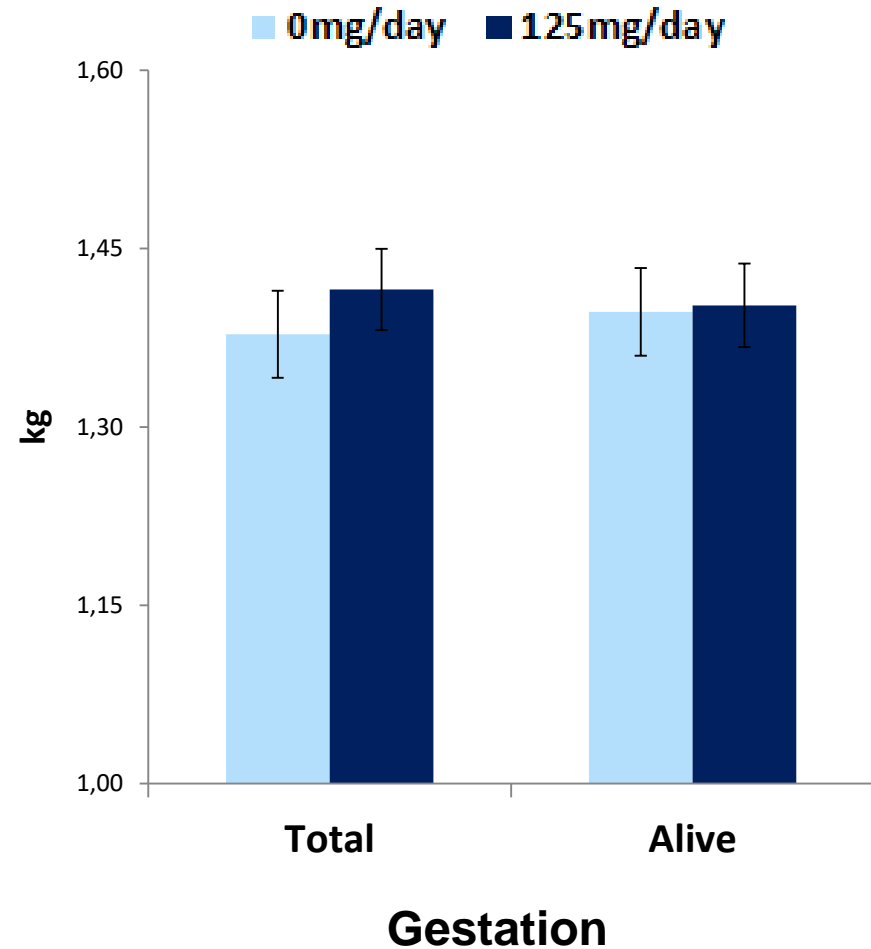
Pre-weaning Performance

Main effects: Birth data

Numbers born

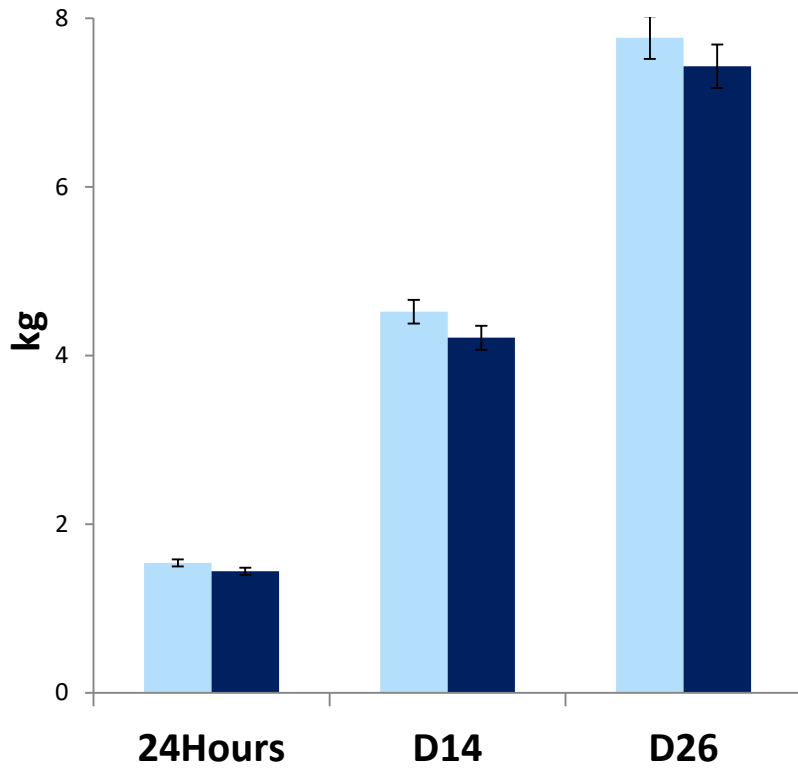


Piglet birthweight



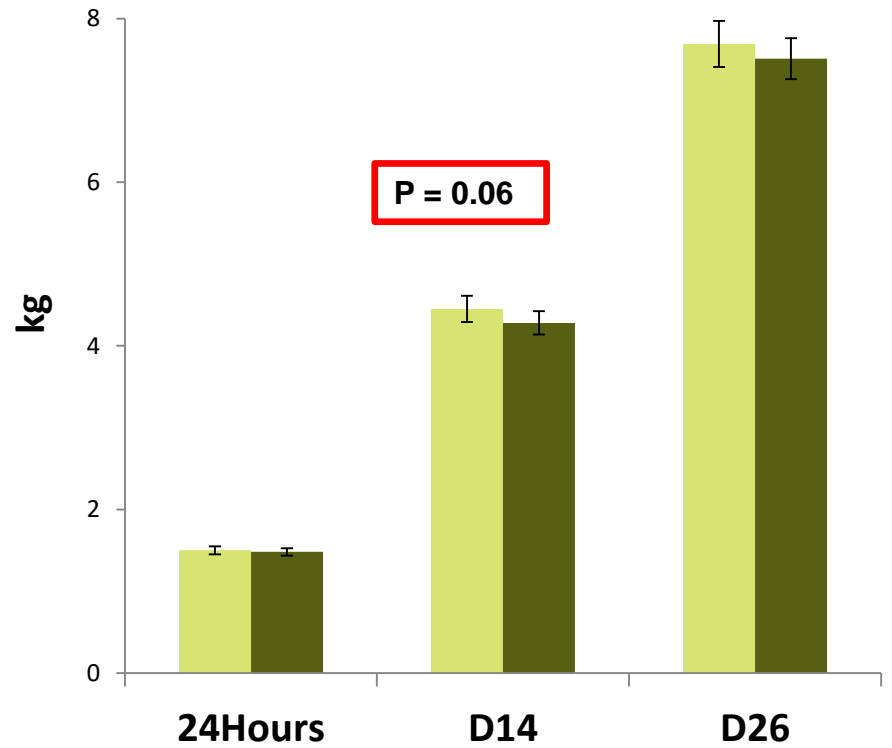
Main effects: Piglet weight

0mg/day 125mg/day



Gestation

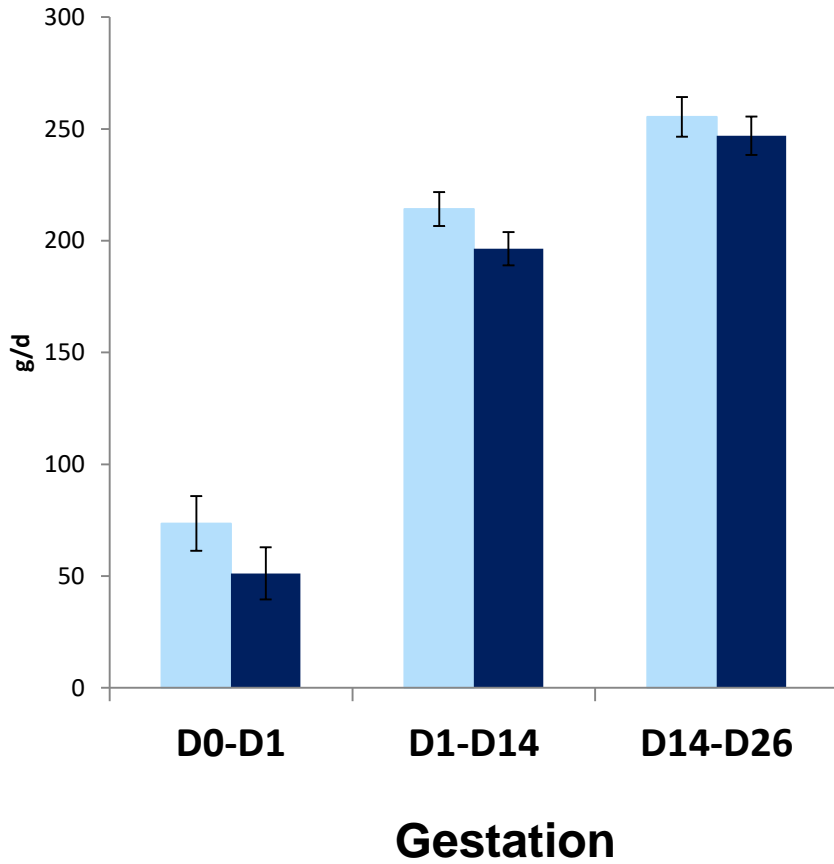
0mg/day 125mg/day



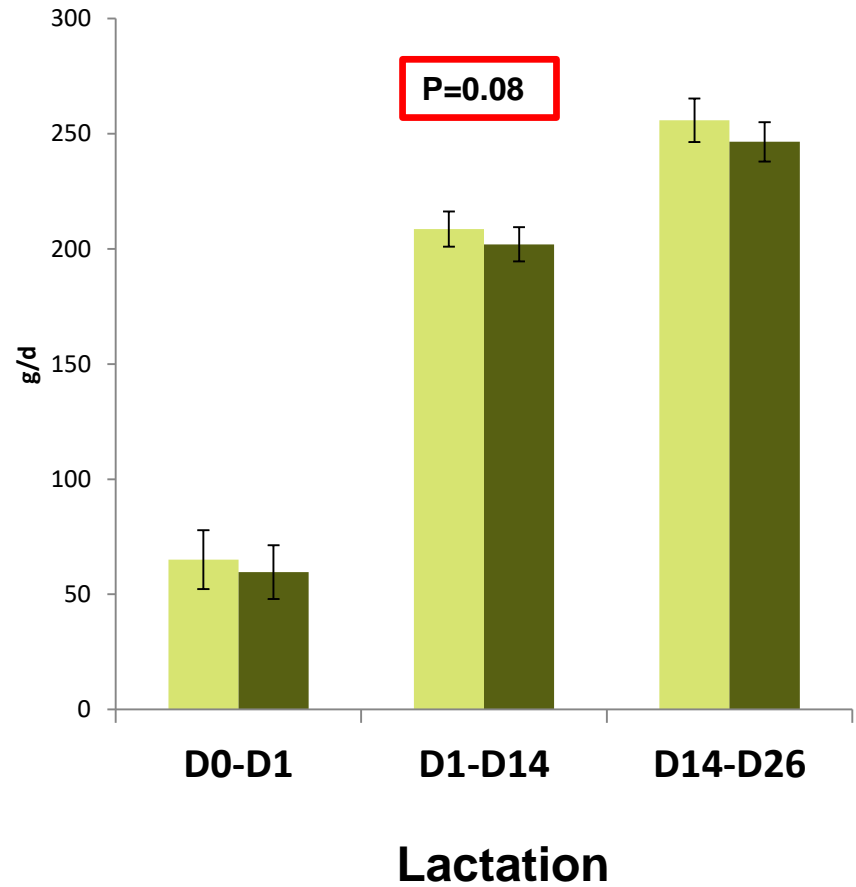
Lactation

Main effects: Piglet ADG

0mg/day 125mg/day



0mg/day 125mg/day

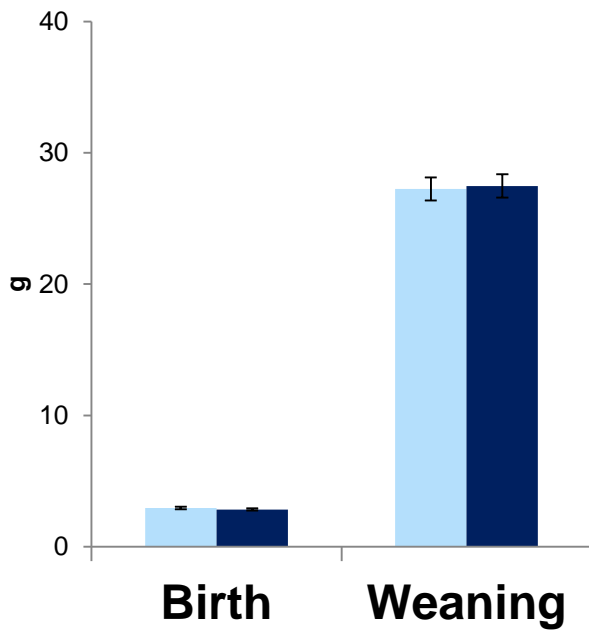


Muscle Data

- No effect of L-carnitine during Gestation

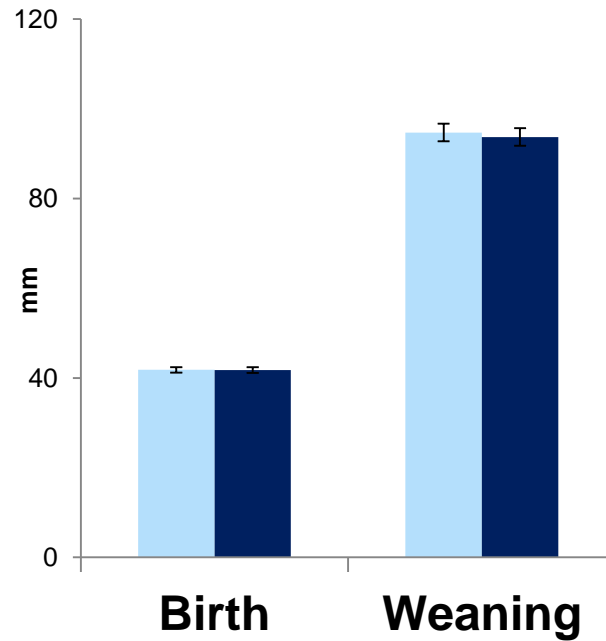
Muscle weight

0mg/day 125mg/day



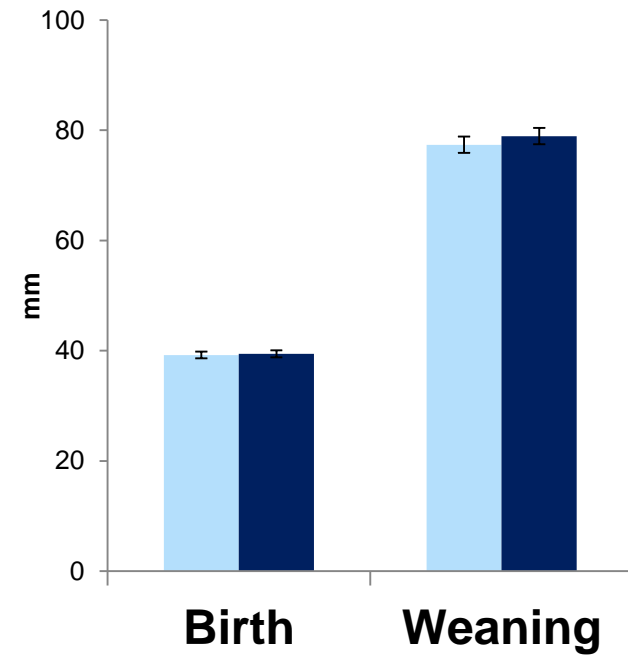
Muscle length

0mg/day 125mg/day



Muscle girth

0mg/day 125mg/day

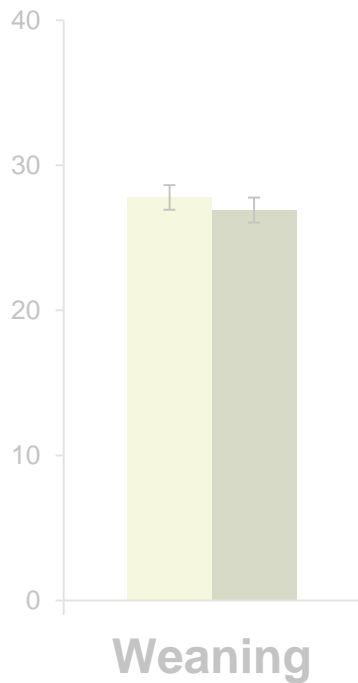


Muscle Data

- No effect of L-carnitine during Lactation
- L-carnitine → ↑ Glucose

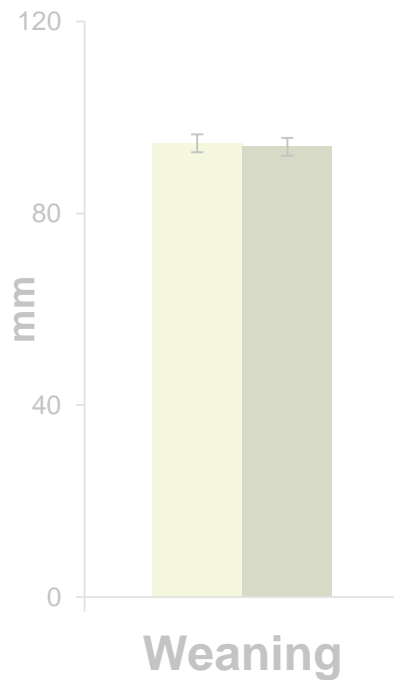
Muscle weight

■ 0mg/day ■ 125mg/day



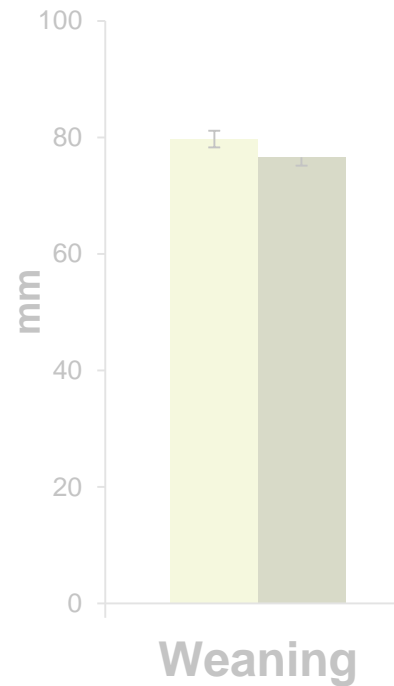
Weight length

■ 0mg/day ■ 125mg/day



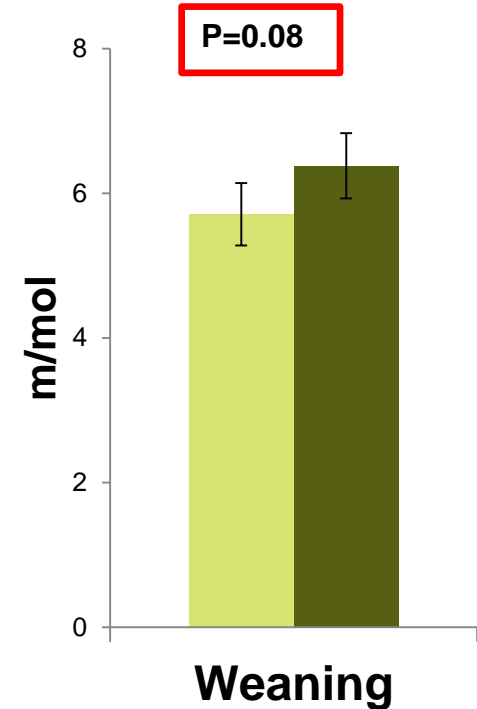
Muscle girth

■ 0mg/day ■ 125mg/day



Piglet glucose

■ 0mg/day ■ 125mg/day





Weaner Performance

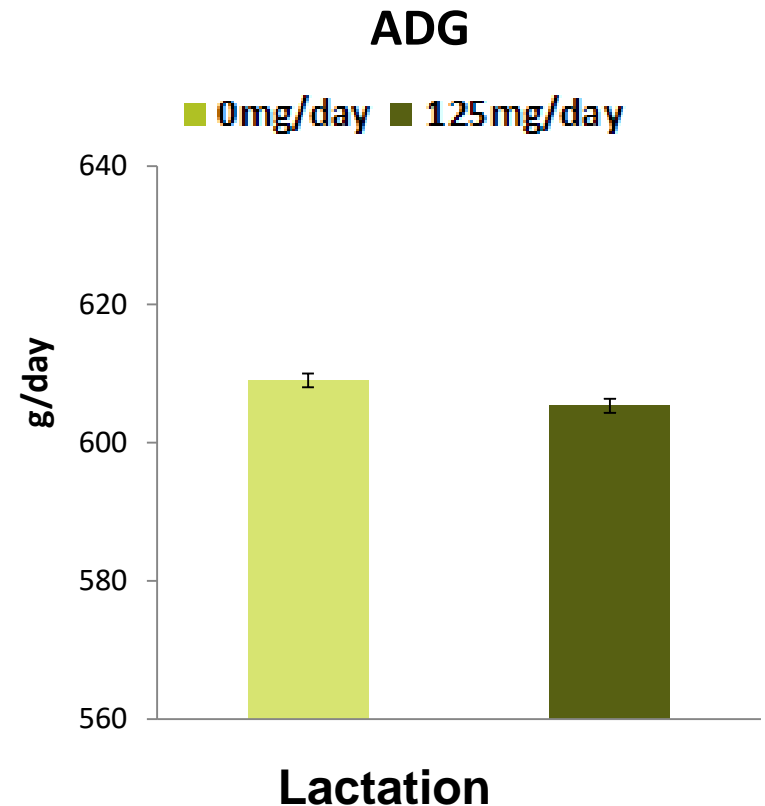
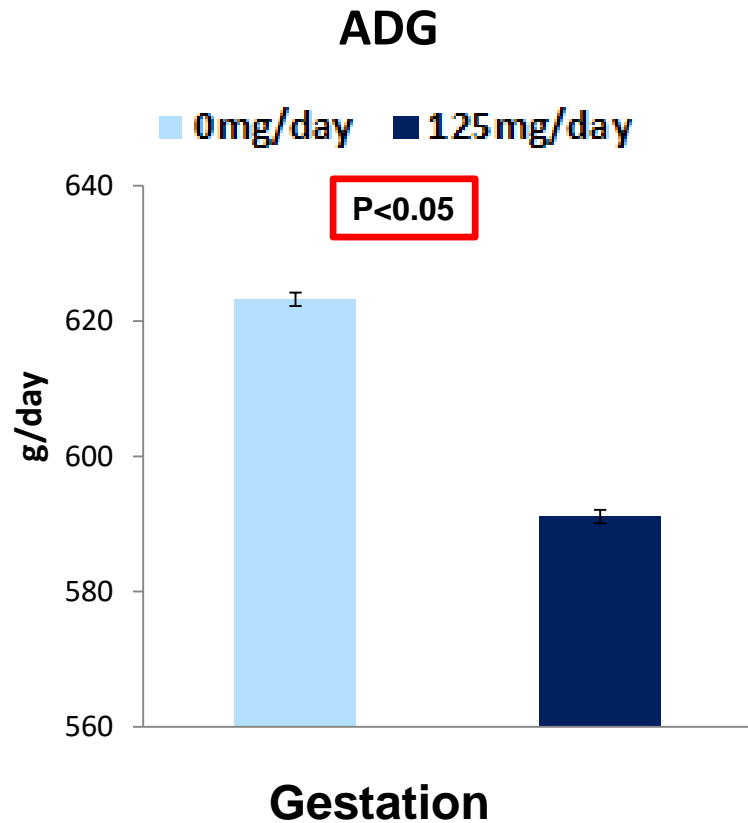
Pig Weight (Days 7- 49pw)

- L-carnitine during lactation → Heaviest pigs
- L-carnitine during gestation & lactation → Lightest pigs

		Treatment				P-value			
Gestation (mg/d):		0	125	0	125				
kg	Lactation (mg/d):	0	0	125	125	SEM	Gest	Lact	Gest*Lact
D7		9.80 ^{ab}	9.69 ^{ab}	10.02 ^a	9.20 ^b	0.16	<0.01	0.39	<0.01
D14		12.51 ^{ab}	12.25 ^{ab}	12.82 ^a	11.67 ^b	0.23	<0.01	0.58	<0.01
D28		20.44 ^{ab}	19.82 ^{ab}	20.79 ^a	18.86 ^b	0.40	<0.01	0.44	<0.01
D49		35.03 ^{ab}	34.61 ^{ab}	36.42 ^a	33.45 ^b	0.70	<0.01	0.78	<0.05

Main effects: Growth (Days 14- 49pw)

- No effect of L-carnitine → ADFI & FCR





Finisher Performance

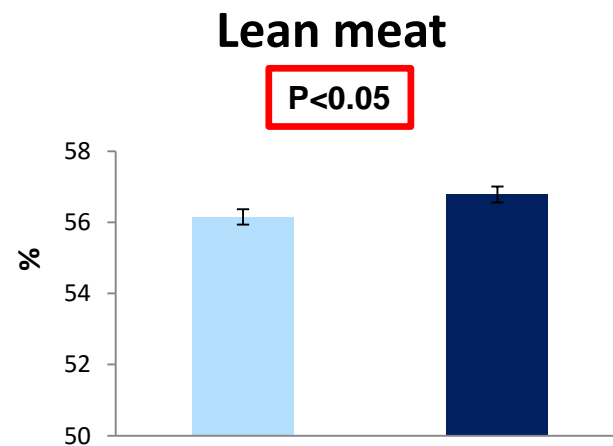
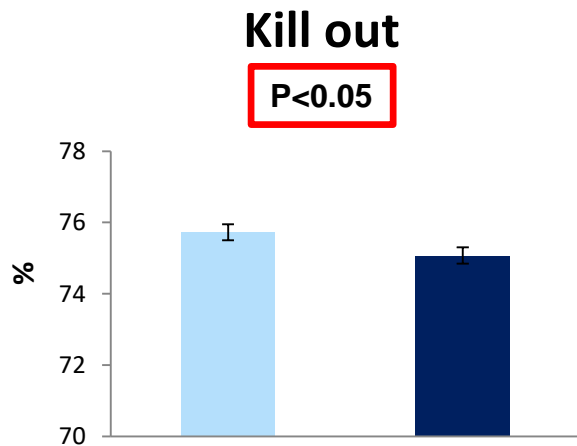
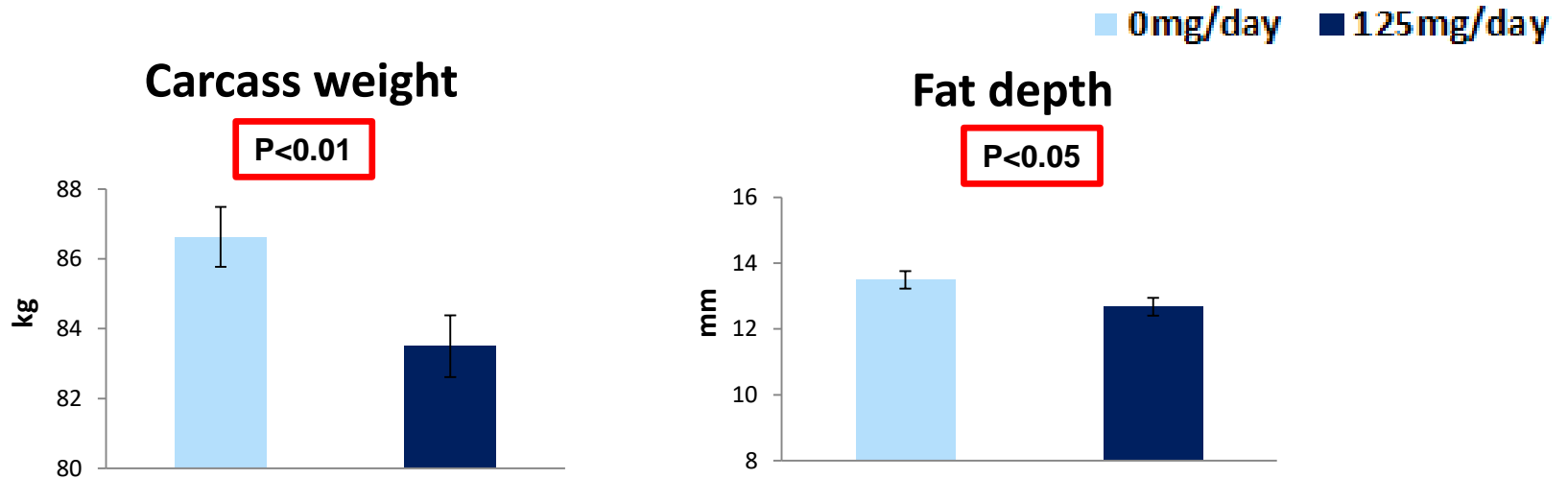
Main effects (Days 49 – 119pw)

- L-carnitine during gestation → ↓ Slaughter weight
- ↓ ADFI
- Improved FCR

Measure	Treatments						P-value	
	Gestation			Lactation			Gest	Lact
	0mg/d	125mg/d	SEM	0mg/d	125mg/d	SEM		
D119, kg	114.84	111.68	0.84	112.71	113.81	0.84	<0.01	0.36
ADG, g/d	1134.79	1121.84	11.24	1119.33	1137.31	11.24	0.39	0.42
ADFI, g/d	2372.08	2259.60	28.08	2300.13	2331.55	28.07	<0.01	0.42
FCR, g/g	2.09	2.01	0.02	2.05	2.05	0.02	<0.05	0.91

Carcass Data (~Day 119pw)

- L-carnitine during Gestation → Reduced weight, fat depth & kill out %
→ Increased lean meat %



Take home message and Discussion



Supplementing sows with L-carnitine

During gestation

- ↑ Total born ✓
- ↑ Lean meat % ✓
- ↓ ADG & ADFI
- ↓ Slaughter weight

During lactation

- ↑ Piglet glucose ✓
- ↑ Pig weight ✓

Combination

- ↓ Pig weight ✗

Discussion

- Unexpected results..
- Consistent with previous work
 - (-) Impact of L-carnitine
 - Increased lean meat %

Thank you for your attention



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