

Exploring variation in feed efficiency of grower-finisher pigs

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Session 34: Sustainable pig and poultry production, including the use of water

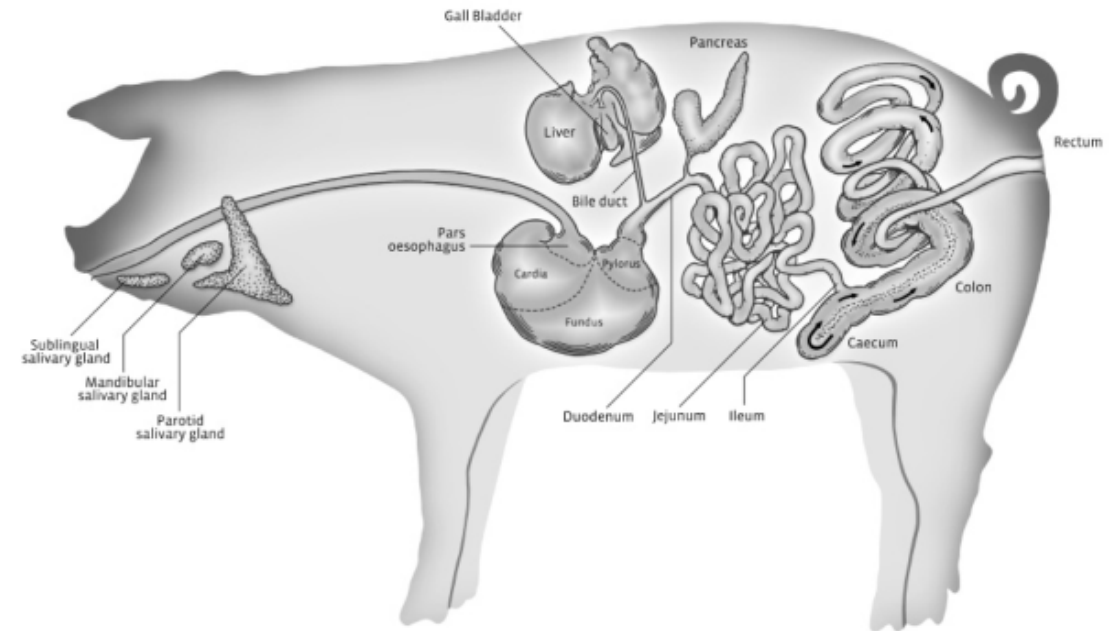


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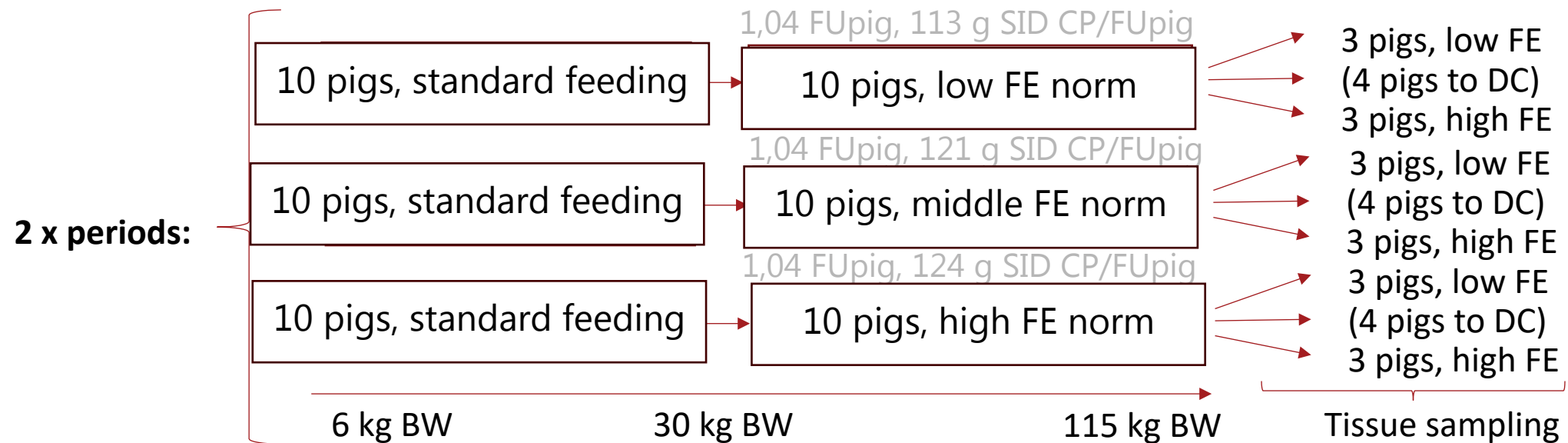
Background

- Feed has huge impact on production costs and CO₂e.
 - >50% of variable production cost
 - ~70% of pigs carbon footprint
- Potential to improve feed efficiency (FE) in slaughter pigs
- Greater understanding of biological factors affecting FE
 - FE variation between animals in same pen?
 - Potential bottlenecks for improvements?
- Explorative study → generating, not testing hypotheses



Experimental design

- A total of 60 pigs
 - Only gilts used
 - 10 pigs/pen
- Three levels of dietary protein from 30-115 kg BW (16 weeks); 113, 121 and 124 g SID CP/FUpig
- Two periods needed
- Individual feed intake registered from 6 kg BW to Slaughter
 - FCR category in 30-115 BW kg phase, is based on performance during 6-30 kg BW phase
- Parameters measured; growth performance and eating behavior



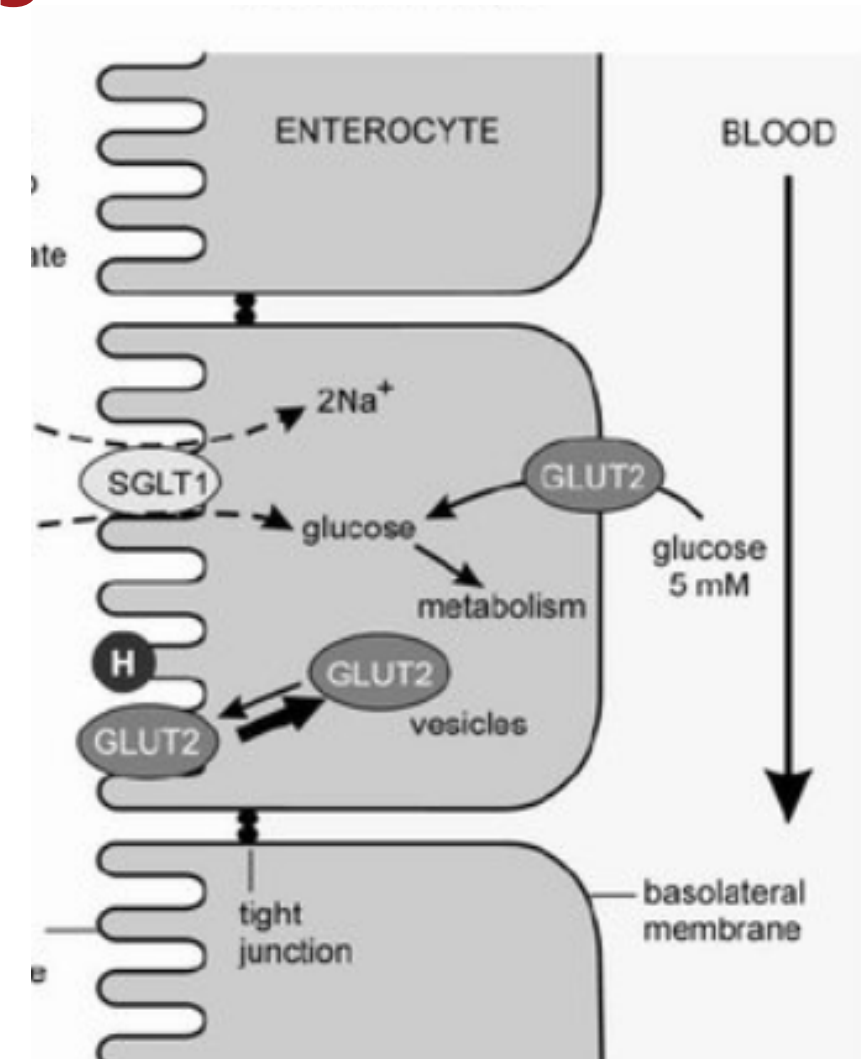
FUpig ~ 8.4-9.0 MJ

DC = Danish Crown

Experimental design – tissue sampling*

- 36 pigs will be analyzed
 - 6 low and 6 high FE pigs per each of the three dietary treatments
 - 8 pigs per dietary treatment go to Danish Crown
- Mainly samples from small intestine
 - Overview of relevant biomarkers
 - Metagenomics (tissue, small intestine)
 - Metabolomics (blood)
 - Sequencing (microbiome, mucosa/content)
 - Gene and protein expression (tissue, small intestine)
 - Nutrient transporters?

*Analyses not covered in this presentation

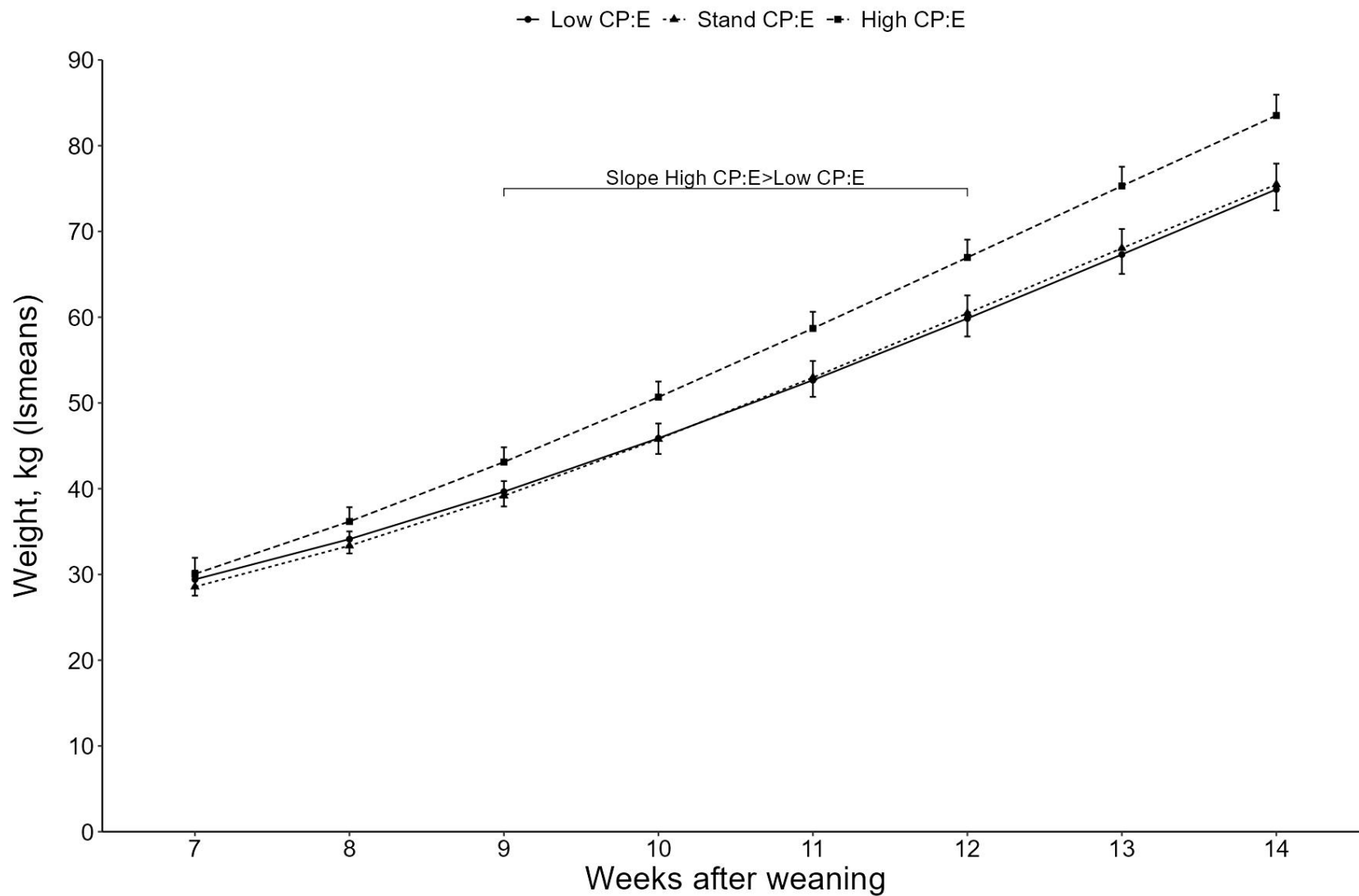


Modified from Kellet og Broc-Laroche, 2005

Statistical analyses

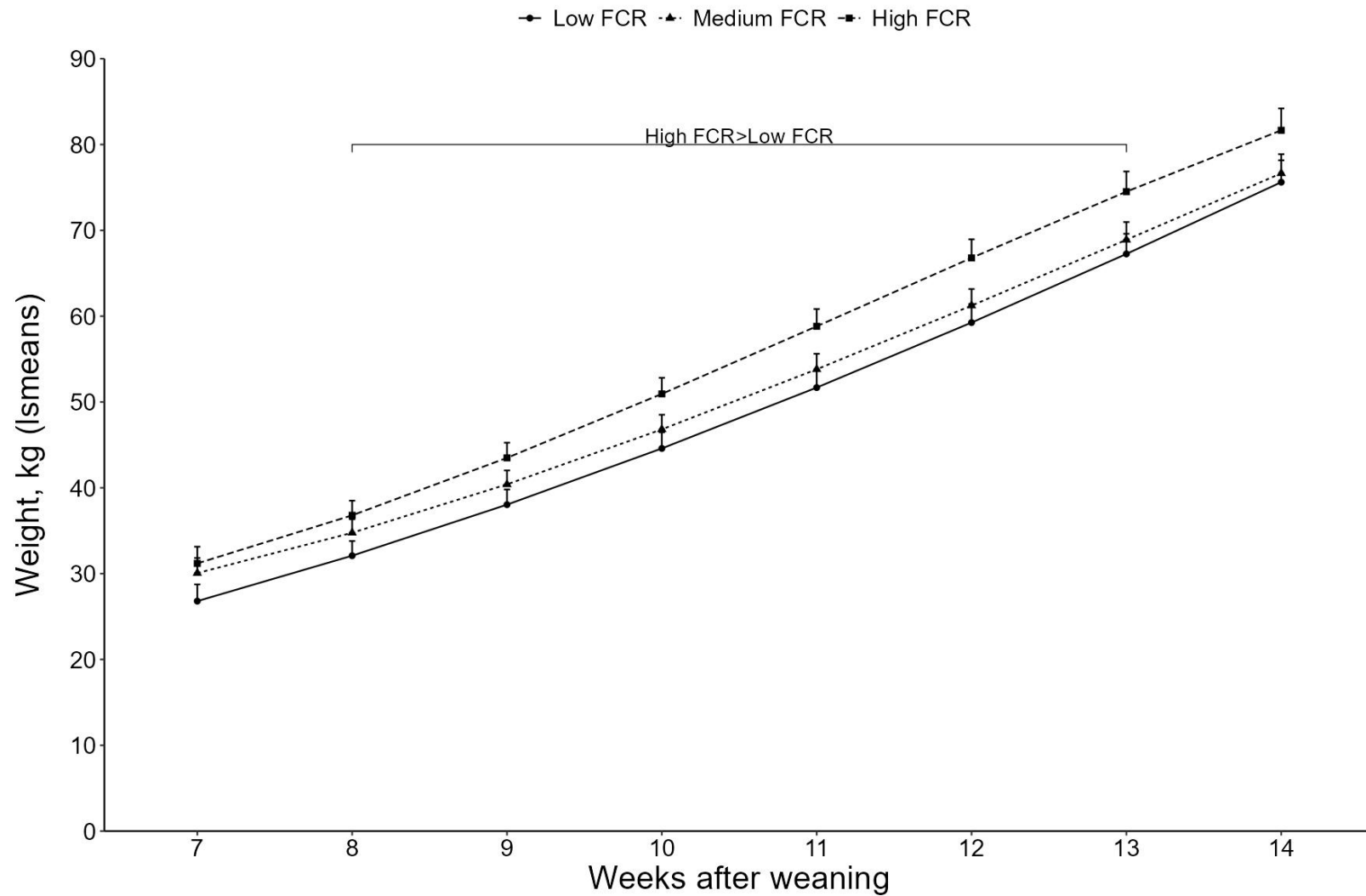
- Analysis of data in grower-finisher phase (after initiation of dietary treatments)
- Fixed effects:
 - X^{th} order (up to 3rd) polynomial of time
 - Dietary treatment: CP:Energy ratio
 - FCR quantile: 20% highest, 20% lowest, rest (middle)
 - Two-way and three-way interactions
 - Initial weight covariate
- Random effects:
 - pigs with time slope (repeated measurements)
 - taking correlation to feed station within period into account
- Preliminary data:
 - Work in progress

Dietary treatment - Bodyweight



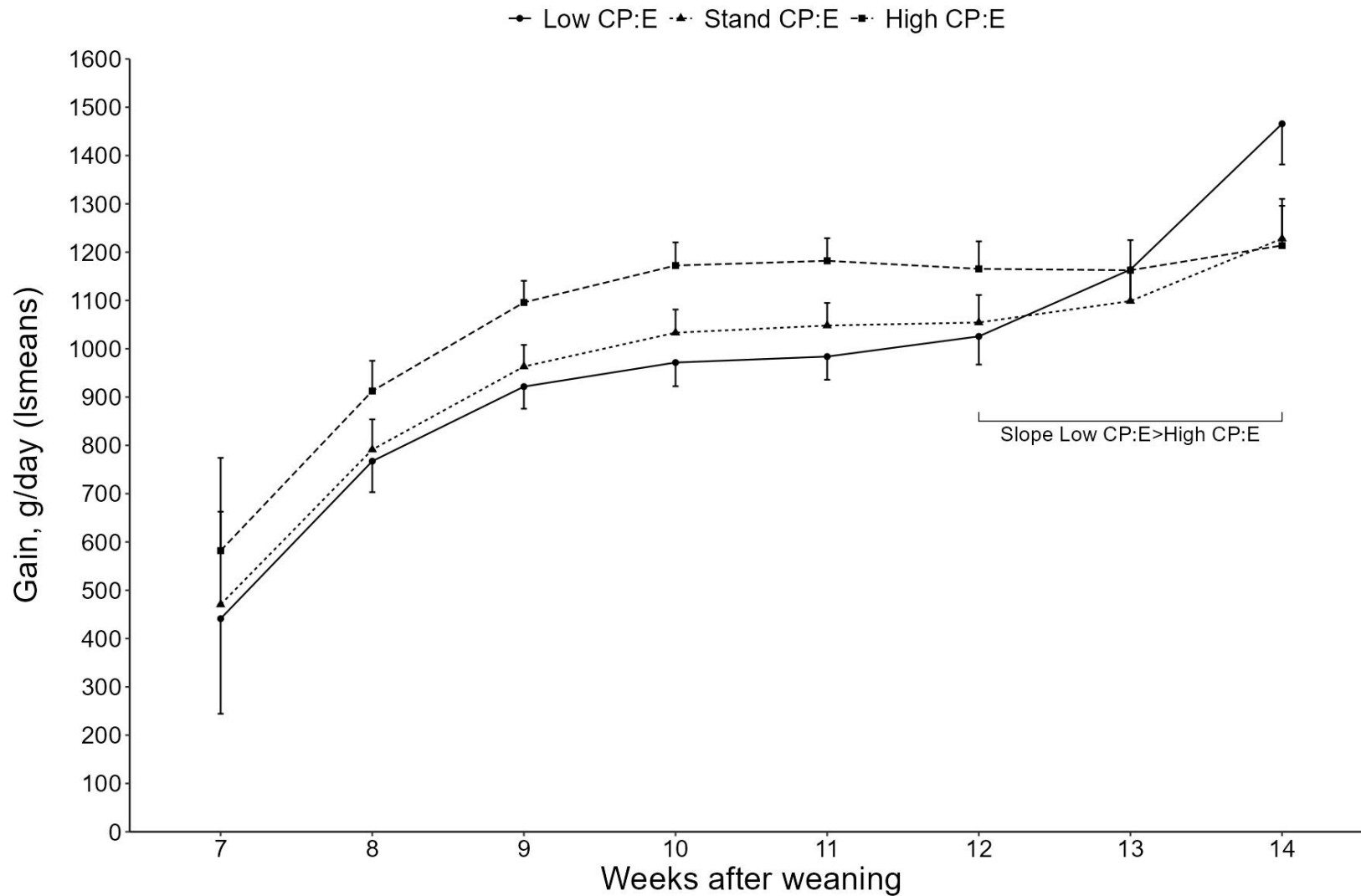
Dependent variables	P-value
Initial Weight	<0.01
Week x FCR quantile	<0.01
Week x Diet	0.04
FCR quantile	<0.01
Dietary treatment	0.54
Week ³	<0.001

FCR quantile - Bodyweight



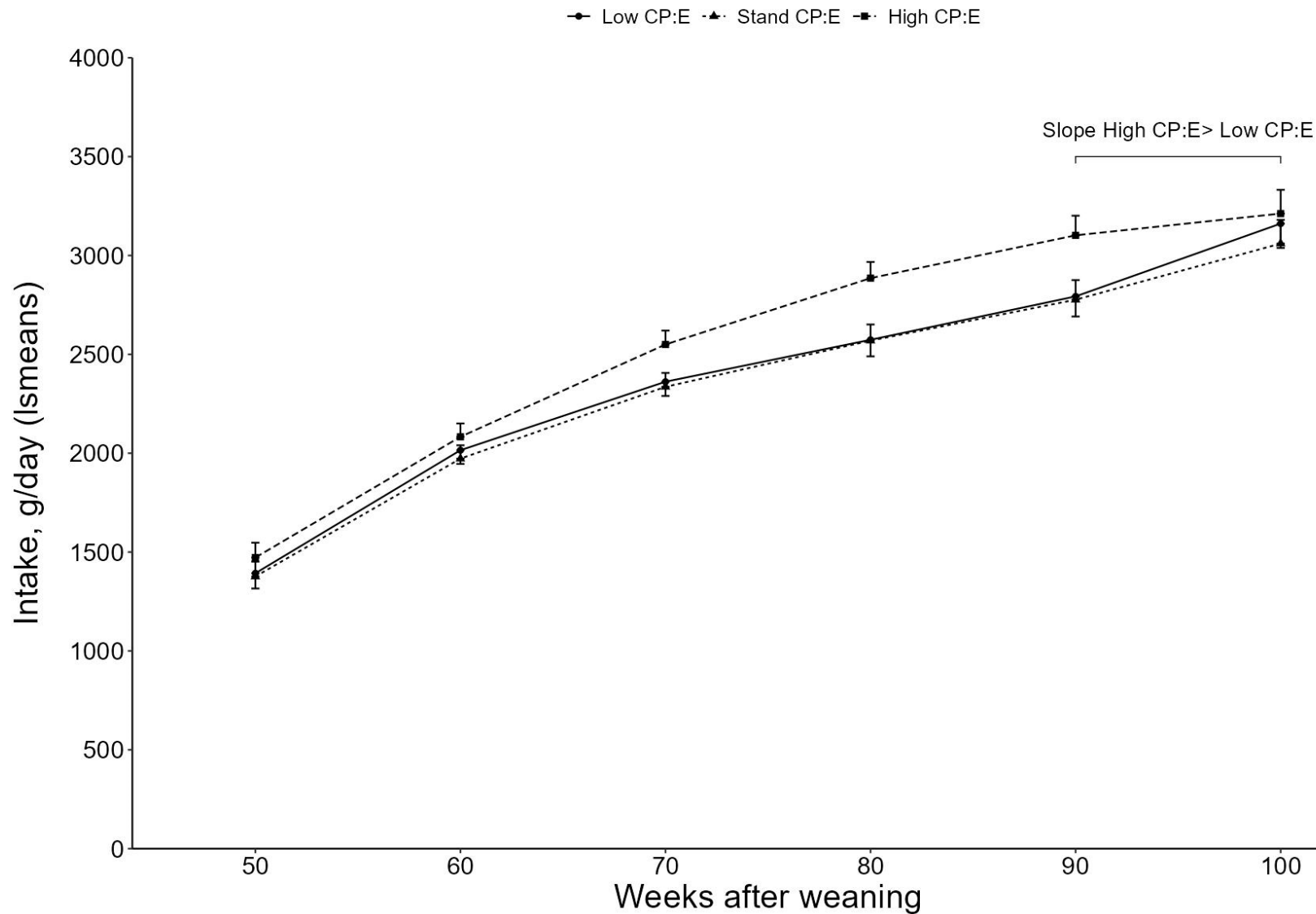
Dependent variables	P-value
Initial Weight	<0.01
Week x FCR quantile	<0.01
Week x Diet	0.04
FCR quantile	<0.01
Dietary treatment	0.54
Week ³	<0.001

Average daily gain - Dietary treatment



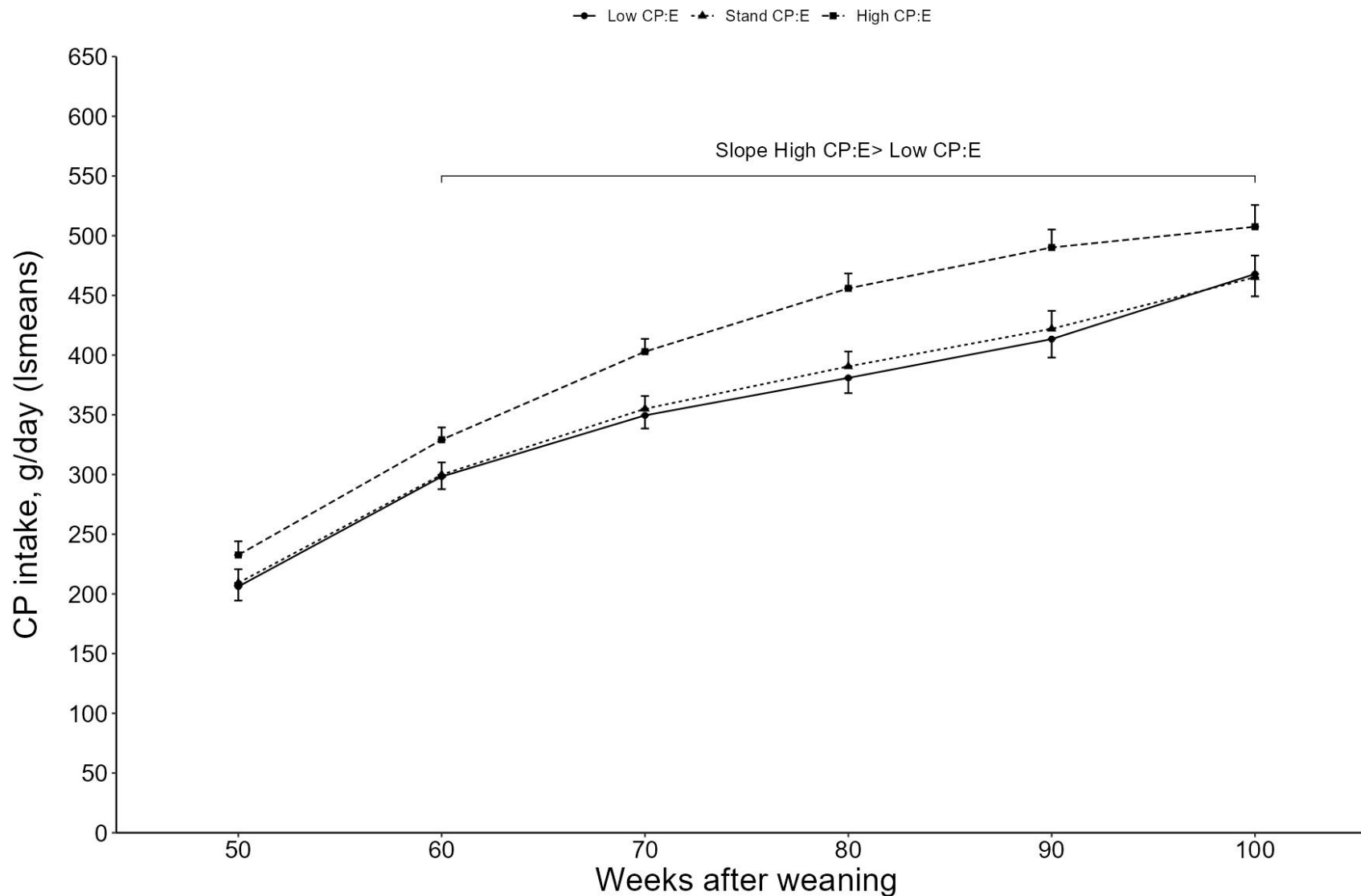
Dependent variables	<i>P-value</i>
Week x Diet	0.02
Dietary treatment	0.13
Week ³	<0.001

Daily intake – Dietary treatment



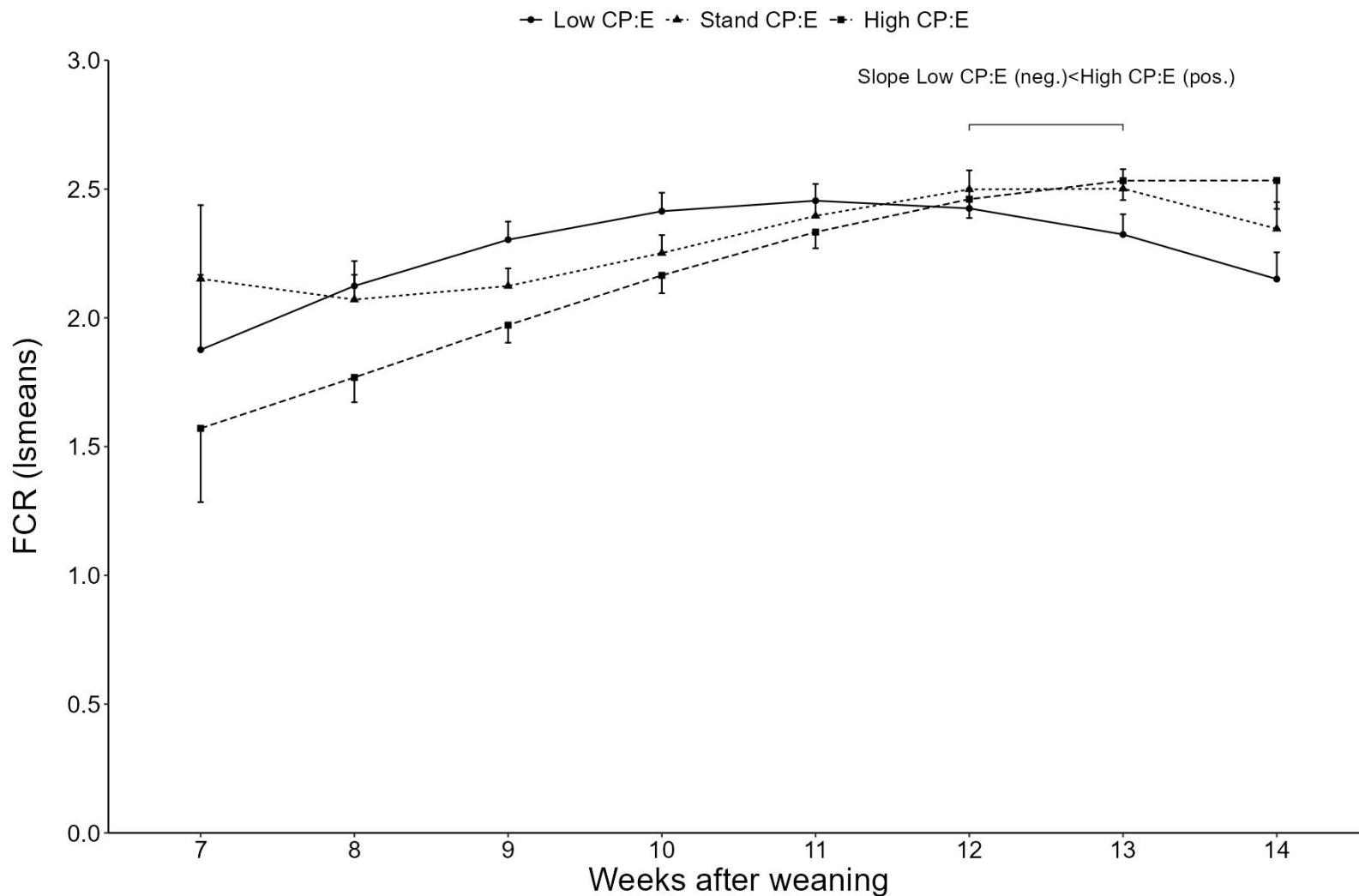
Dependent variables	<i>P</i> -value
Day x Diet	<0.001
Dietary treatment	0.33
Week ³	<0.001

CP intake – Dietary treatment



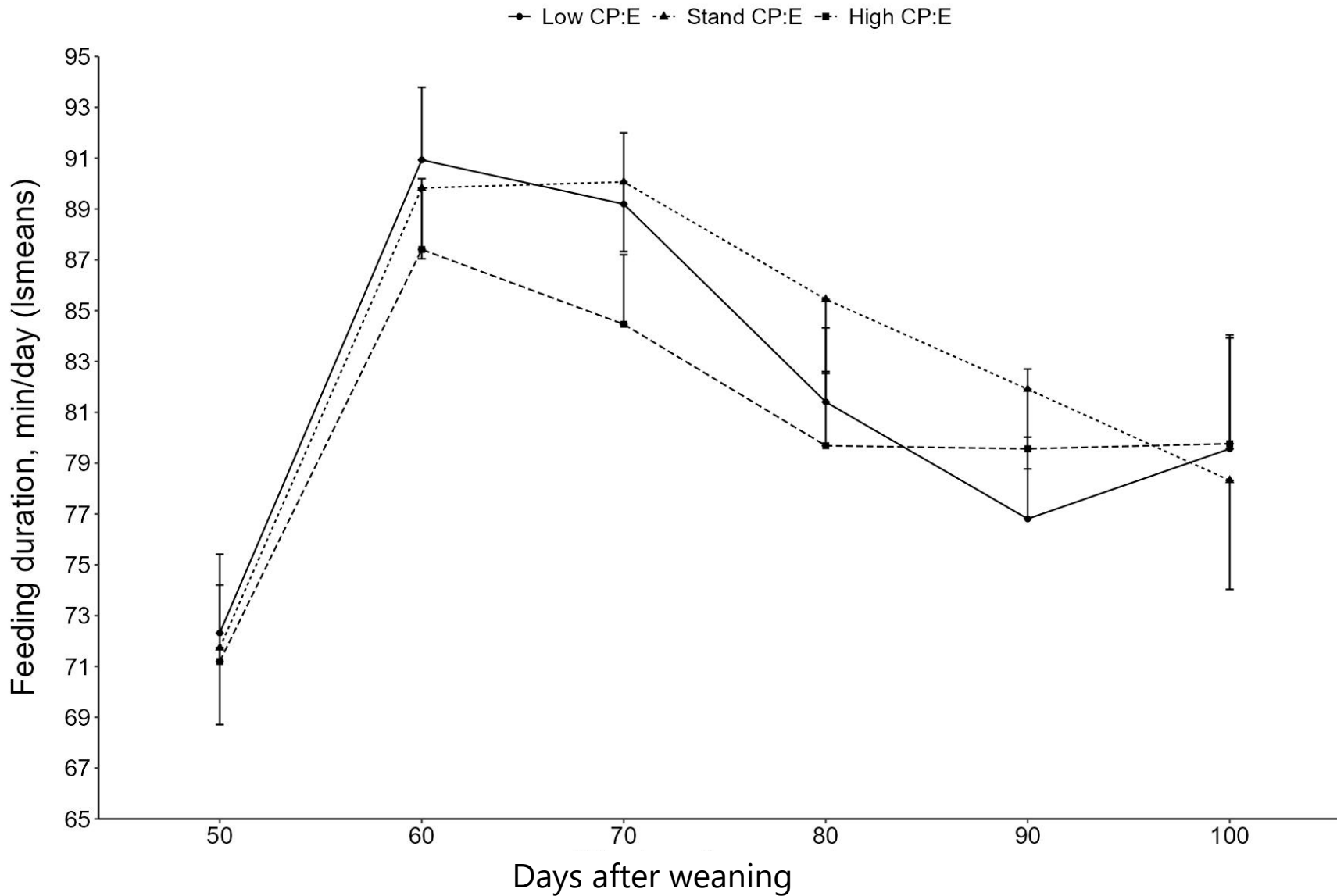
Dependent variables	P-value
Day x Diet	<0.01
Dietary treatment	0.09
Week ³	<0.001

Feed conversion ratio - Dietary treatment



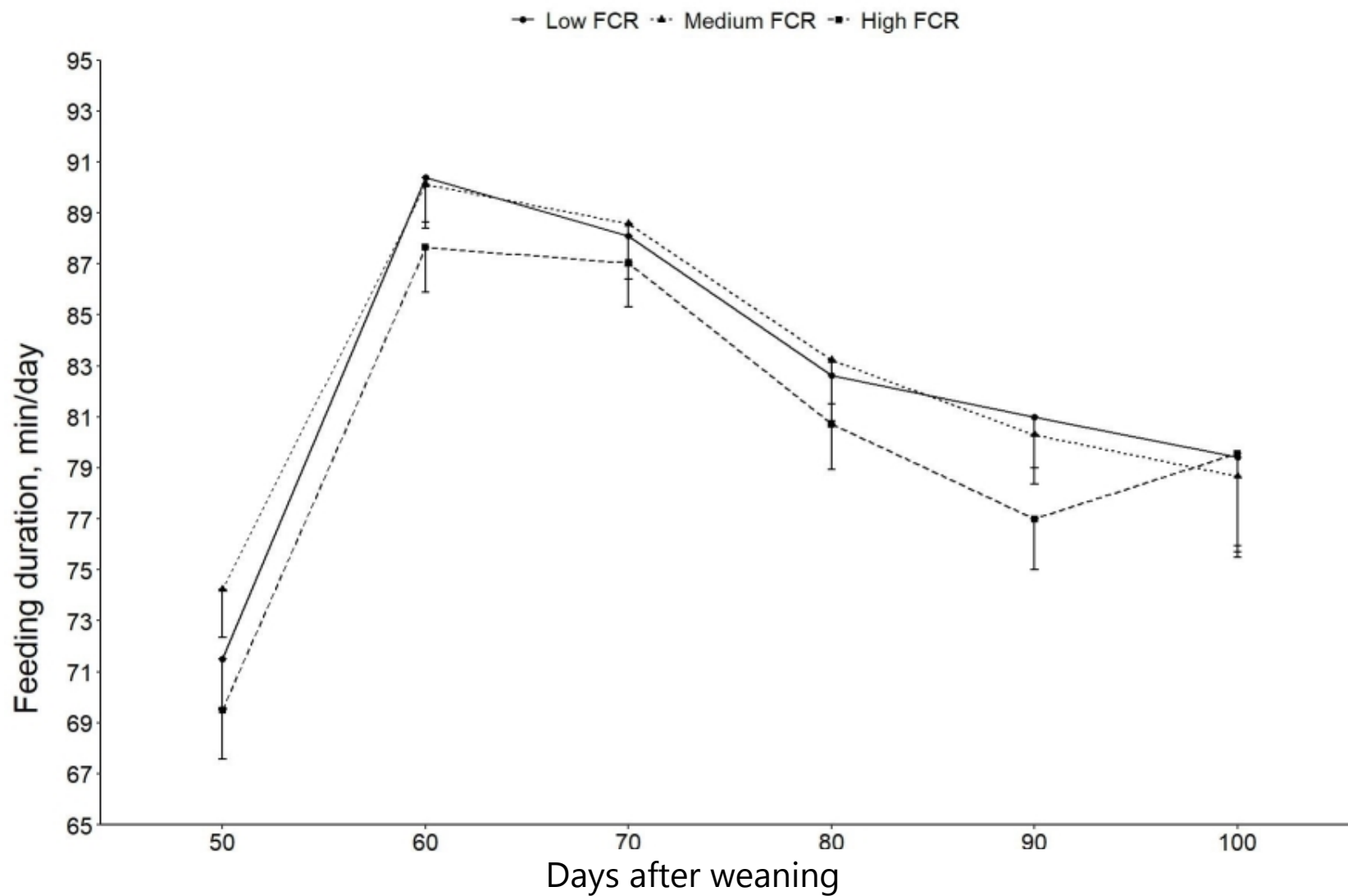
Dependent variables	Final model	<i>P-value</i>
Week x Diet	Yes	<0.01
Dietary treatment	Yes	0.24
Week ³	Yes	<0.001

Feeding duration – Dietary treatment



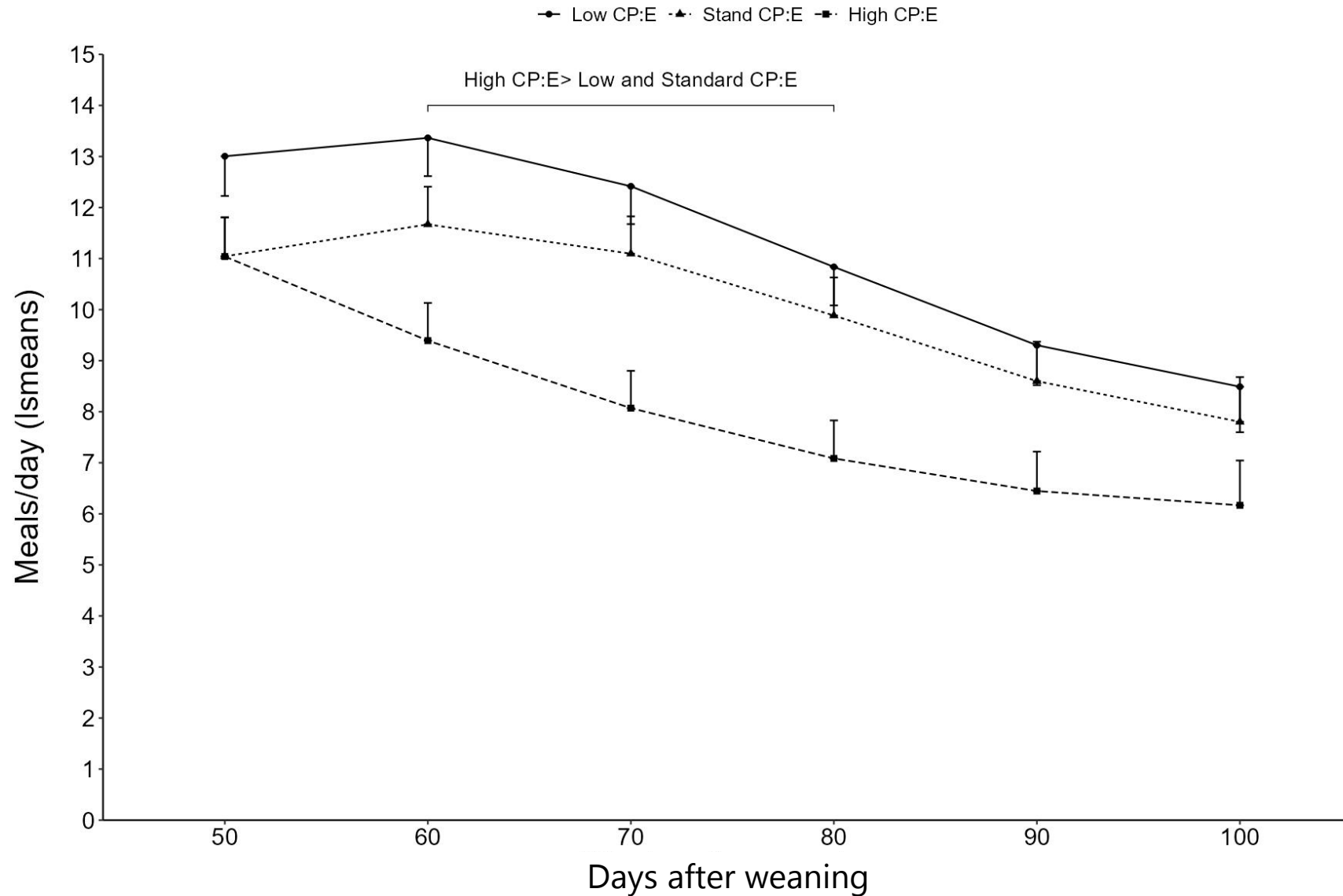
Dependent variables	<i>P-value</i>
Diet x FCR quantile x Day	<0.01
Day x FCR quantile	<0.001
Day x Diet	<0.01
FCR quantile	<0.001
Dietary treatment	0.70
Week ⁴	<0.0001

Feeding duration - FCR quantile



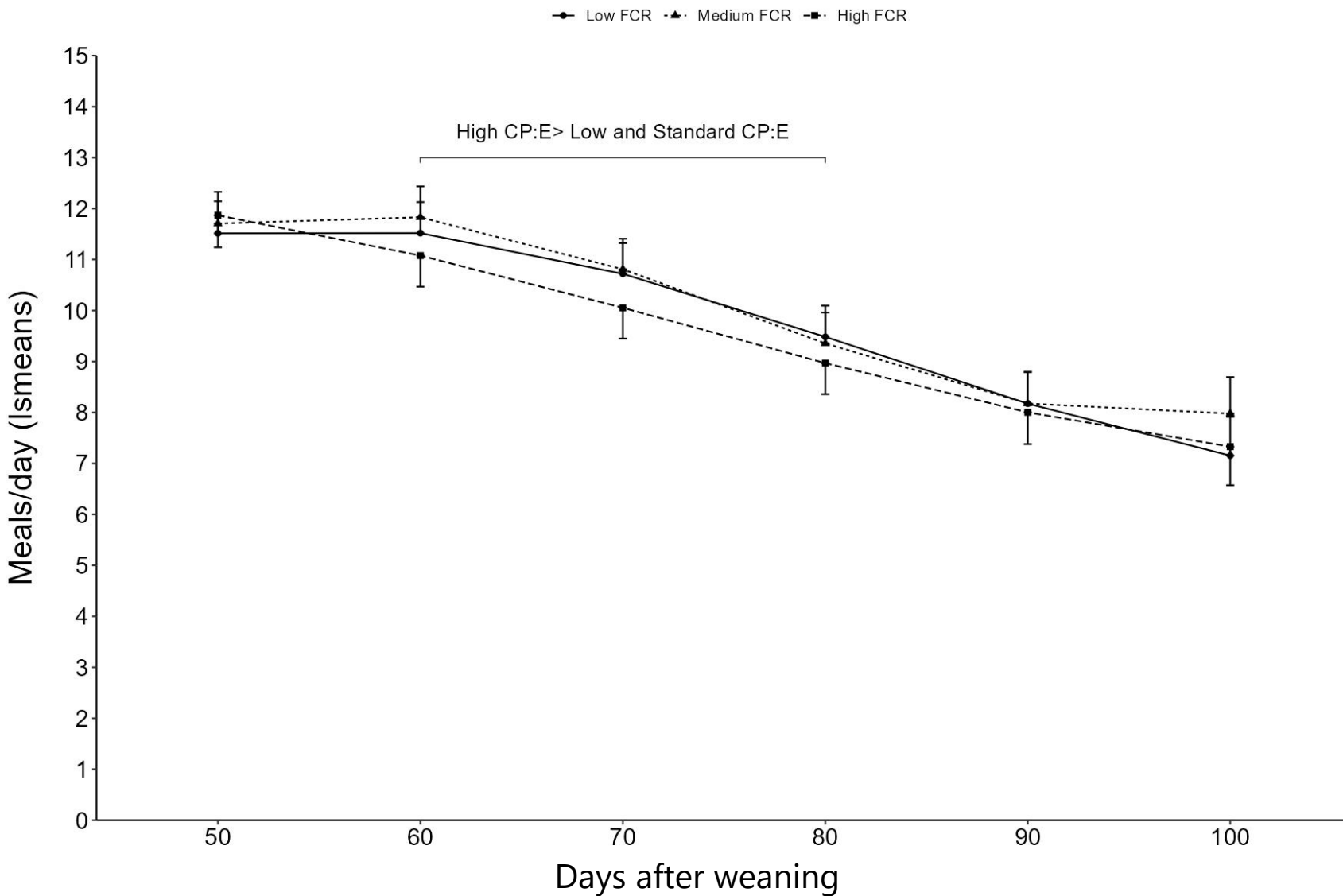
Dependent variables	P-value
Diet x FCR quantile x Day	<0.01
Day x FCR quantile	<0.001
Diet x FCR quantile	0.41
Day x Diet	<0.01
FCR quantile	<0.001
Dietary treatment	0.70
Week ⁴	<0.0001

Meal frequency – Dietary treatment



Fixed dependent variables	P-value
Diet x FCR quantile x day	<0.001
day x FCR quantile	0.001
Diet x FCR quantile	0.07
day x Diet	0.001
FCR quantile	<0.01
Dietary treatment	0.07
Day ³	<0.0001

Meal frequency - FCR quantile



Fixed dependent variables	P-value
Diet x FCR quantile x day	<0.001
day x FCR quantile	0.001
Diet x FCR quantile	0.07
day x Diet	0.001
FCR quantile	<0.01
Dietary treatment	0.07
Day ³	<0.0001

Discussion

- Expected greater slope of BW development of high CP:E treatment (unexpected high FCR pigs).
- Low CP:E treatment gaining momentum in ADG and FCR
 - Compensatory growth in low CP:E treatment?
 - Oversupply of protein in high CP:E from 12 weeks?
- Possibility to change between CP:E levels during grower-finisher period?
- Feeding behaviour
 - Feeding stations
 - CP level biological feedback
 - Further feeding behaviours (feeding rate, meal size)
- Method of choosing feed efficiency quantile?



Conclusion

- Change in efficiency of protein utilization over time
 - Pig does not remain in same FE category between weeks (data not shown)
- Indicates response to dietary CP level is of dynamic nature during grower-finisher phase
- Complicates adjustment of CP:E level to FE level of pigs during grower-finisher phase

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