Overview of nutritional, genetic, and management strategies to influence mortality after weaning

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Wean to finish mortality overview

- Economic cost of mortality (Ag Decision Maker) – Lee Schulz – Iowa State
- Causes of wean to finish mortality – Jordan Gebhardt – Kansas State
- Predictors of wean-to-finish mortality – Daniel Linhares – Iowa State
- Attractants to ease transition to nursery – Anna Johnson – Iowa State
- Field studies to reduce wean-to-finish mortality – Mike Tokach – Kansas State
- Antibiotic interventions to reduce wean-to-finish mortality – Chris Rademacher – Iowa State

Written September, 2021
File B1-78

pdf | Pig survivability project: Wean-to-finish mortality economic modeling

Assessing Economic Opportunity of Improving Mortality Rate in Wean-to-Finish Swine Production

If pig production is profitable, lowering the mortality rate improves net income. However, it can be difficult to determine what cost can be incurred to lower mortality rate and achieve a profit. The purpose of this fact sheet is not to determine the cost of mortality mitigation strategies but to help producers determine the income opportunity of improving mortality in their operation as compared to the potential cost of a strategy to lower mortality. Mortality reduction strategies and costs will most certainly vary among operations and situations.

A budget model is commonly used to project economic costs and returns and this fact sheet and accompanying spreadsheet use estimated budgets and sensitivity tables to highlight and compare net income changes due to changes in mortality rates. The main economic costs and returns of changing mortality are highlighted.

The main revenue factors that change with increased mortality are less revenue from market hog sales and the value of manure. On the cost side, feed, feed manufacturing, marketing and potentially health expenses decrease as pigs die. Some of the factors such as feed, feed manufacturing, health expenses and manure value, are affected by the timing of when pigs die during the feeding period.

The information provided here is designed to serve as an economic guide to the value of improving mortality for the wean-to-finish phase of the production process. The main inputs included in the budget are:

Revenue Change

Market hog sales

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Mortality cost, $/pig

- 1% change = $0.82 to $1.20

Table 3. Sensitivity analyses of net income per head by carcass price, feed price and feed efficiency

		Carcass price per hundredweight				
Net income per head		$ 66.00	$ 68.00	$ 70.00	$ 72.00	$ 74.00
Mortality %	4.00%	$ 0.39	$ 4.42	$ 8.46	$ 12.50	$ 16.53
	5.00%	$ (0.57)	$ 3.42	$ 7.42	$ 11.41	$ 15.40
	6.00%	$ (1.53)	$ 2.42	$ 6.37	$ 10.32	$ 14.28
	7.00%	$ (2.49)	$ 1.42	$ 5.33	$ 9.24	$ 13.15
	8.00%	$ (3.45)	$ 0.42	$ 4.29	$ 8.15	$ 12.02

		Feed price per pound				
Net income per head		$ 0.07	$ 0.08	$ 0.09	$ 0.10	$ 0.11
Mortality %	4.00%	$ 22.79	$ 15.62	$ 8.46	$ 1.30	$ (5.87)
	5.00%	$ 21.65	$ 14.54	$ 7.42	$ 0.30	$ (6.82)
	6.00%	$ 20.52	$ 13.45	$ 6.37	$ (0.70)	$ (7.77)
	7.00%	$ 19.39	$ 12.36	$ 5.33	$ (1.70)	$ (8.73)
	8.00%	$ 18.26	$ 11.27	$ 4.29	$ (2.70)	$ (9.68)

		Feed efficiency (pound of feed per pound of gain)				
Net income per head		2.60	2.65	2.70	2.75	2.80
Mortality %	4.00%	$ 11.01	$ 9.73	$ 8.46	$ 7.19	$ 5.91
	5.00%	$ 9.95	$ 8.68	$ 7.42	$ 6.15	$ 4.89
	6.00%	$ 8.89	$ 7.63	$ 6.37	$ 5.12	$ 3.86
	7.00%	$ 7.83	$ 6.58	$ 5.33	$ 4.08	$ 2.83
	8.00%	$ 6.77	$ 5.53	$ 4.29	$ 3.05	$ 1.80

Postweaning mortality in commercial swine production. I: review of non-infectious contributing factors

Jordan T. Gebhardt,[†,1] Mike D. Tokach,[†] Steve S. Dritz,[‡] Joel M. DeRouchey,[†] Jason C. Woodworth,[†] Robert D. Goodband,[†] and Steve C. Henry[‖]

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Postweaning mortality in commercial swine production II: review of infectious contributing factors

Jordan T. Gebhardt,[1,2,3,†,4] Mike D. Tokach,[†] Steve S. Dritz,[‡] Joel M. DeRouchey,[†] Jason C. Woodworth,[†] Robert D. Goodband,[†] and Steve C. Henry[‖]

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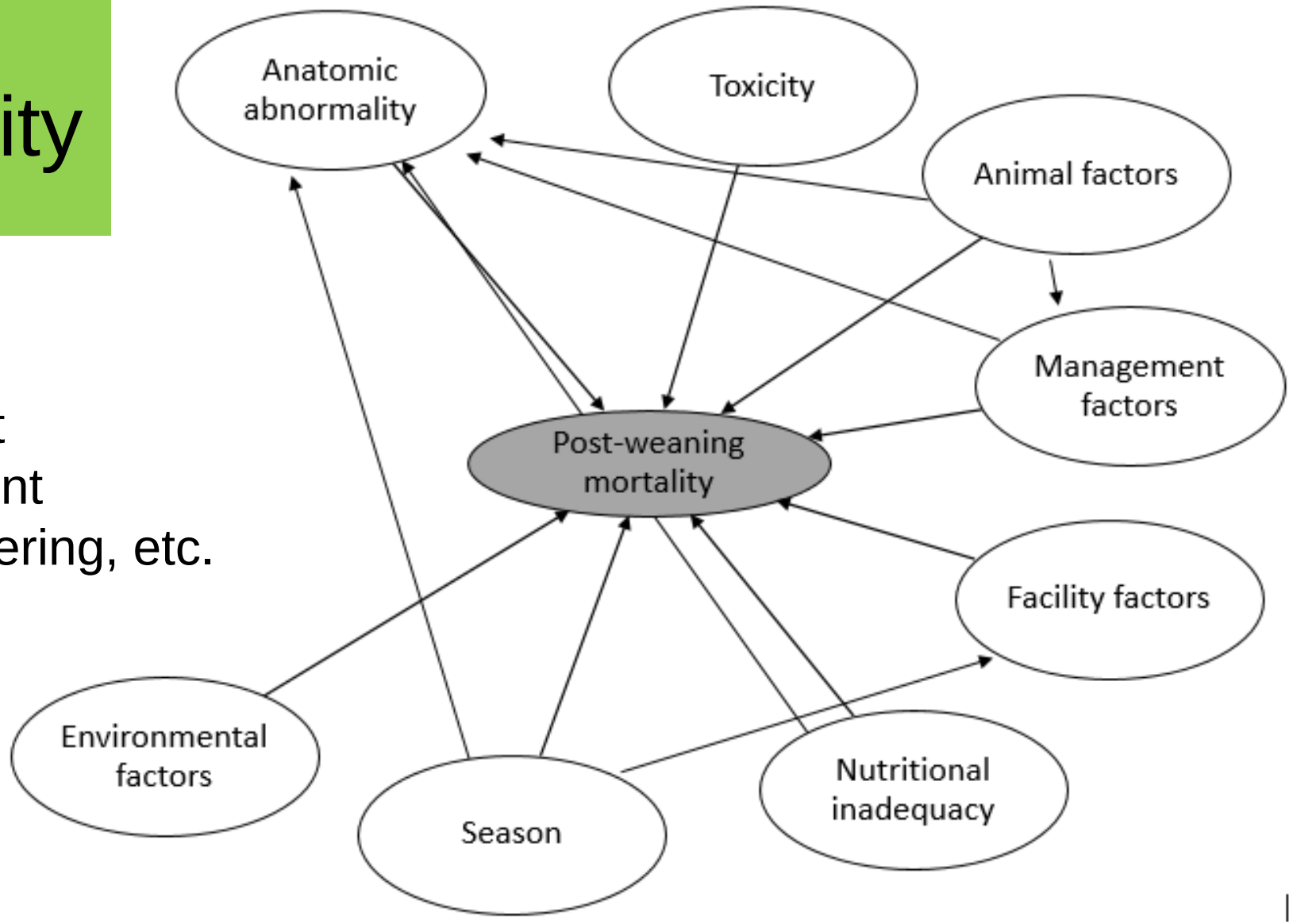
Translational Animal Science - doi: 10.1093/tas/txaa052 & 10.1093/tas/txaa068

Non-infectious causes of mortality

High magnitude of impact

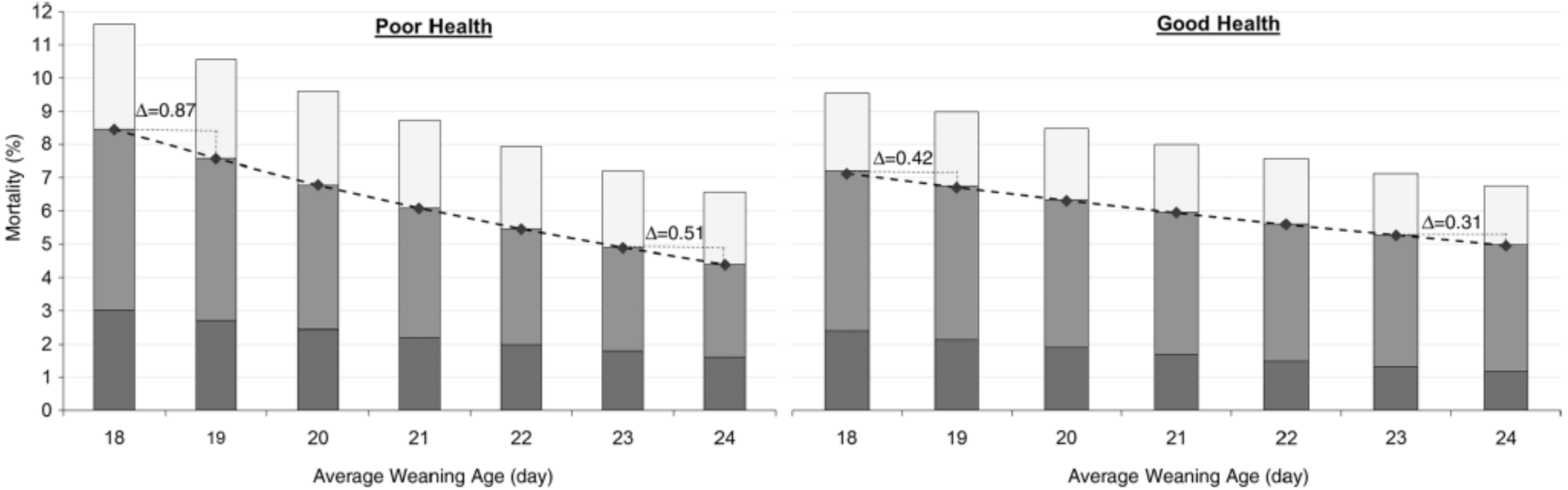
- Birth weight
- Weaning age and weight
- Pre-weaning management
  - colostrum, cross-fostering, etc.
- Season



IMPROVING PIG SURVIVABILITY

Gebhardt et al., 2019

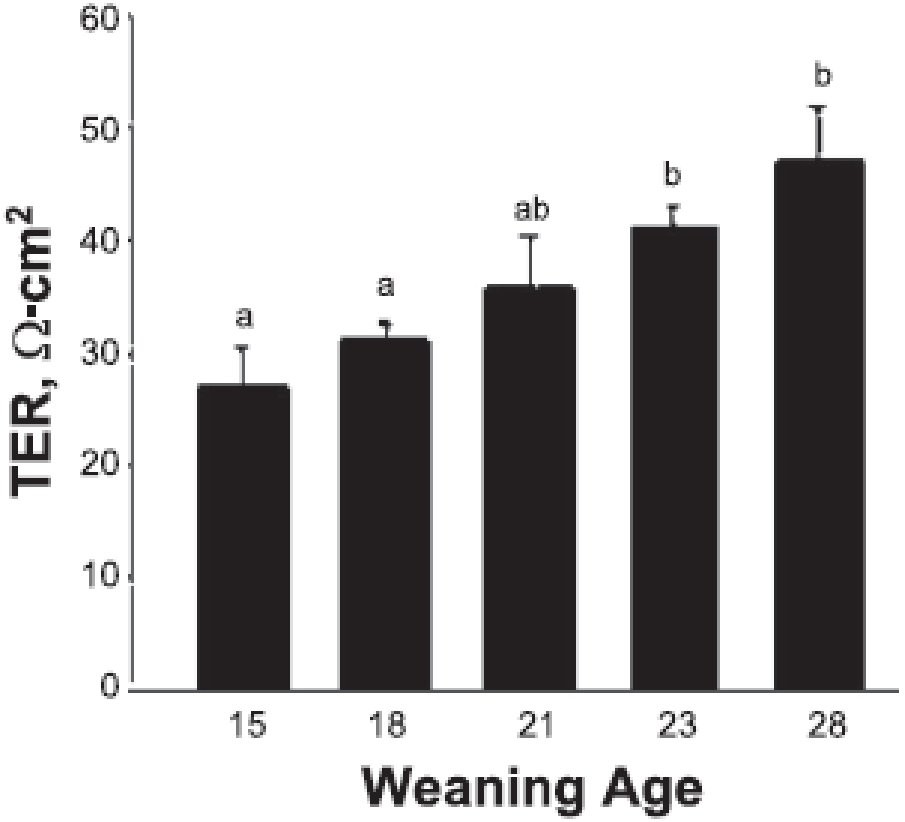
Influence of weaning age on wean-to-finish mortality and percentage off-grade pigs

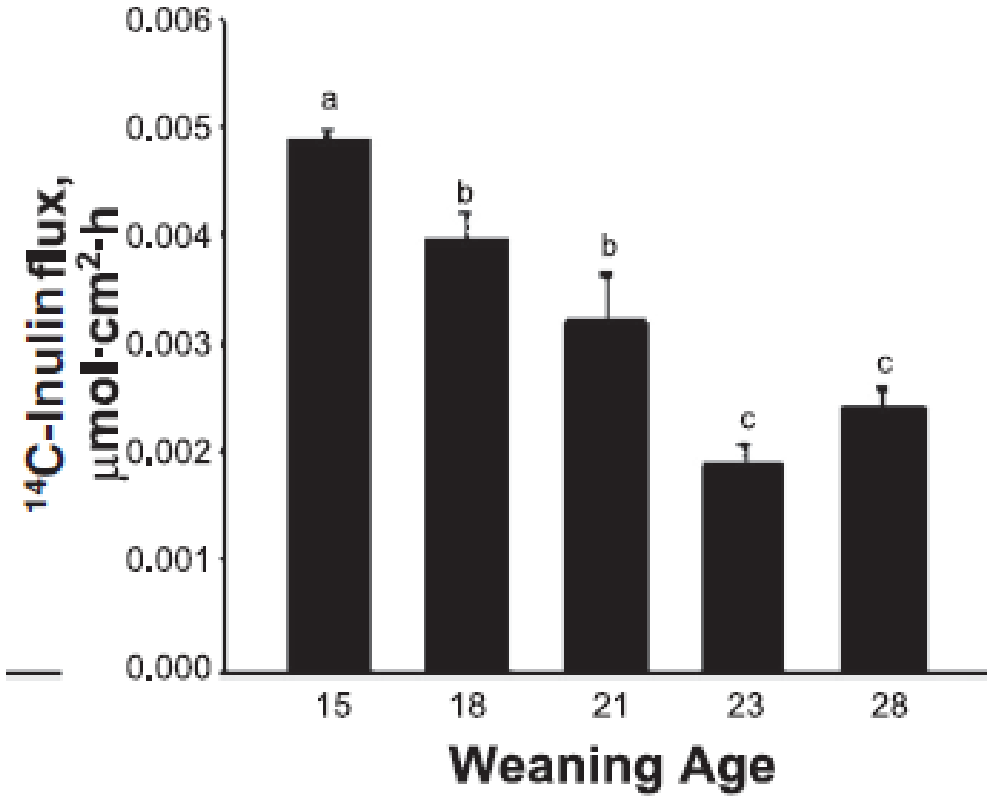


Poor health: Mortality, % = Exponential [4.10 + (-0.109 × wean age); $P = 0.003$
Good health: Mortality, % = Exponential [3.05 + (-0.0601 × wean age); $P = 0.04$

Boyd et al., 2020

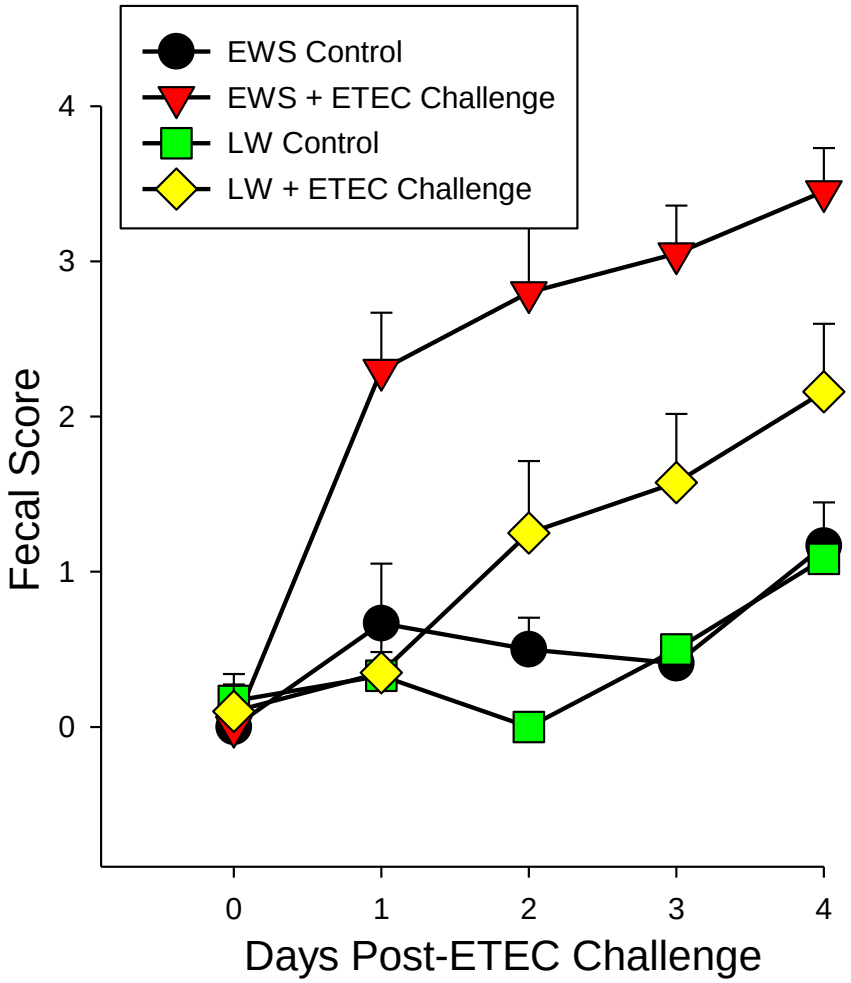
Effect of weaning age on intestinal permeability

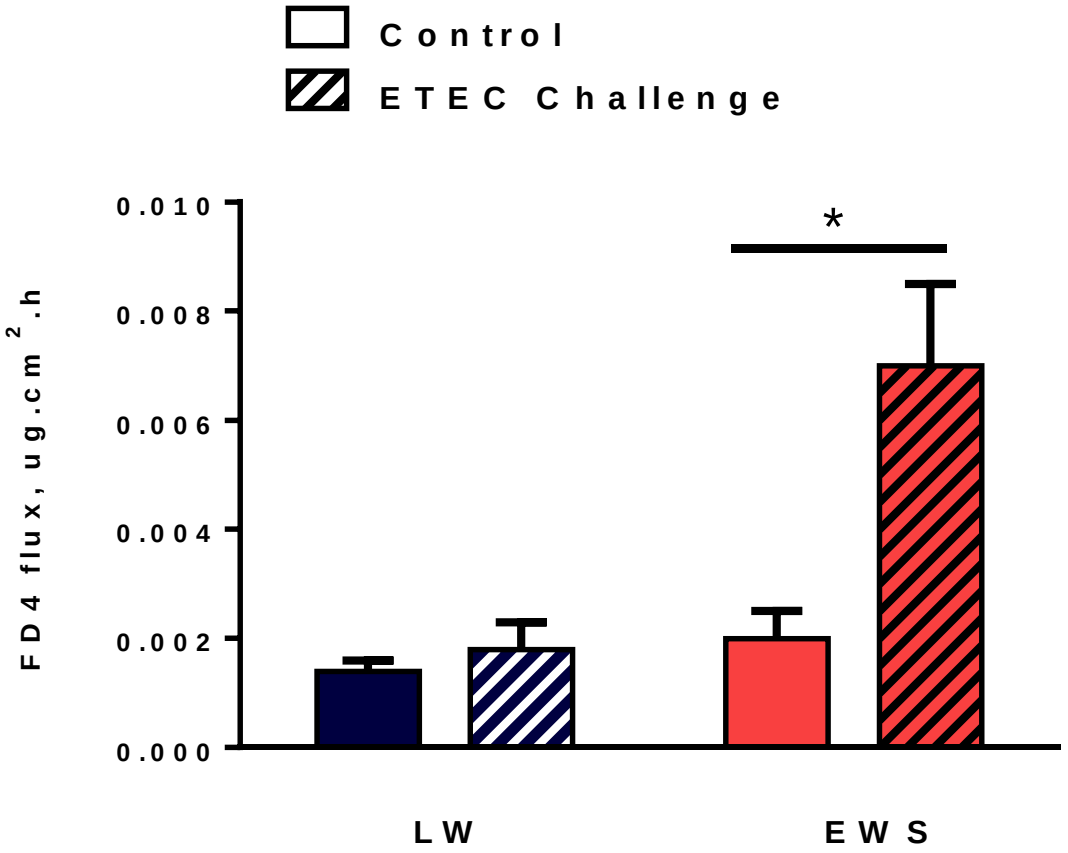




Smith et al., 2010

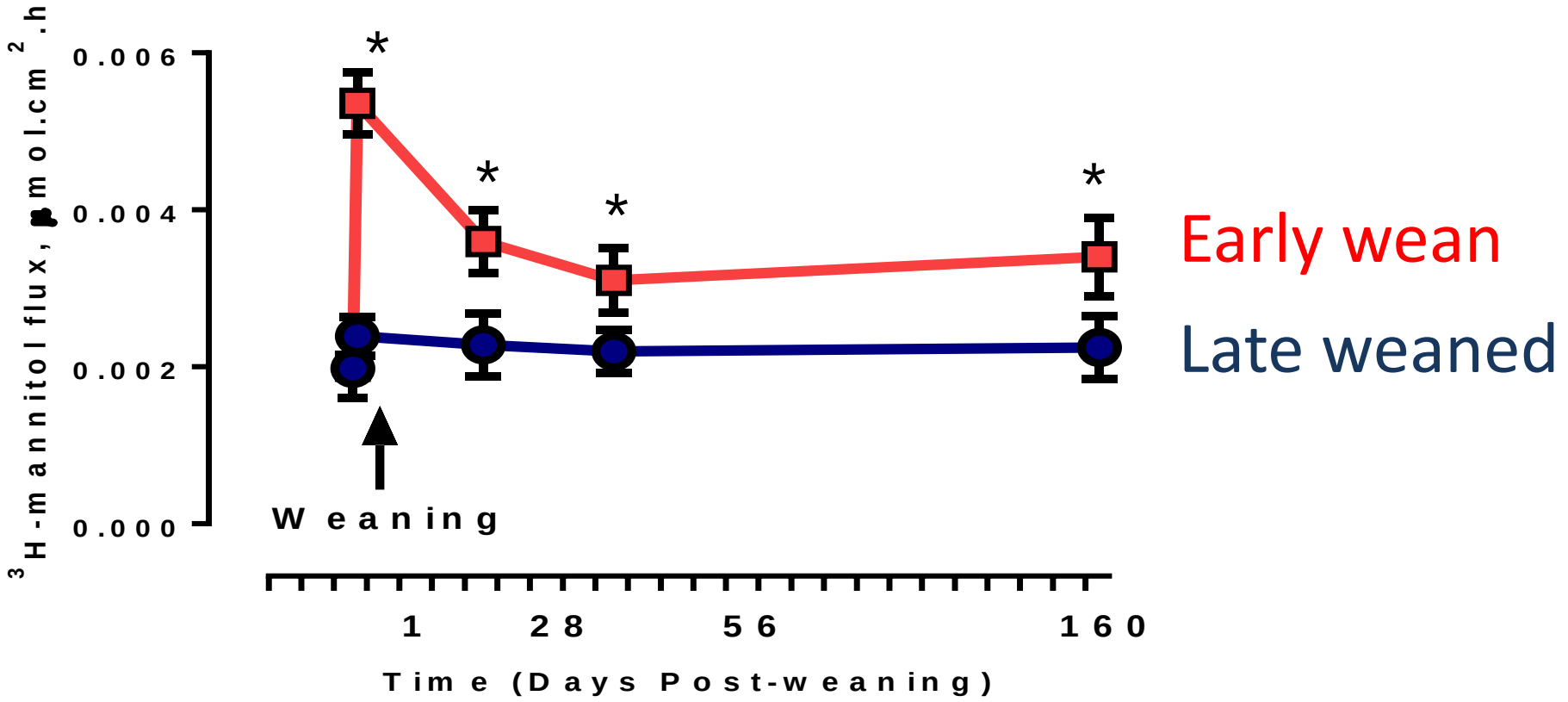
Early weaning leads to increased clinical disease in response to subsequent *E. coli* Challenge





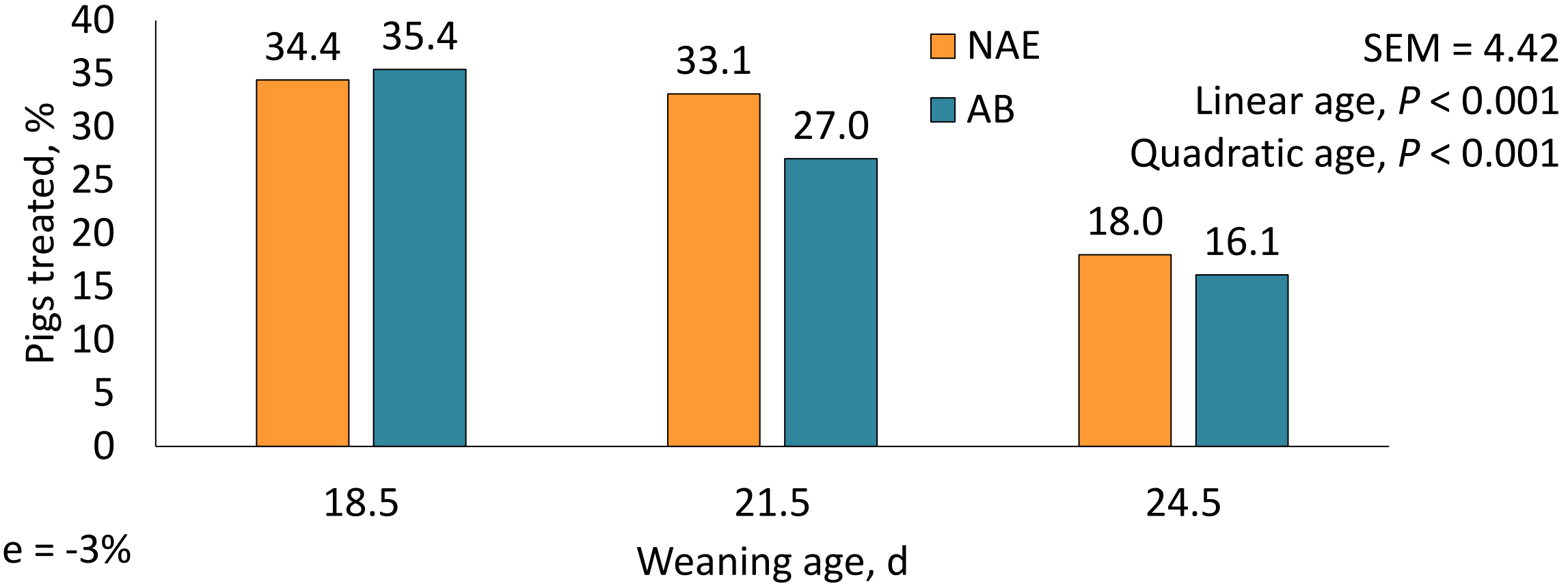
McLamb et al., 2013

Long-Term Effects of Early Weaning Stress on Intestinal Permeability



Moeser et al.

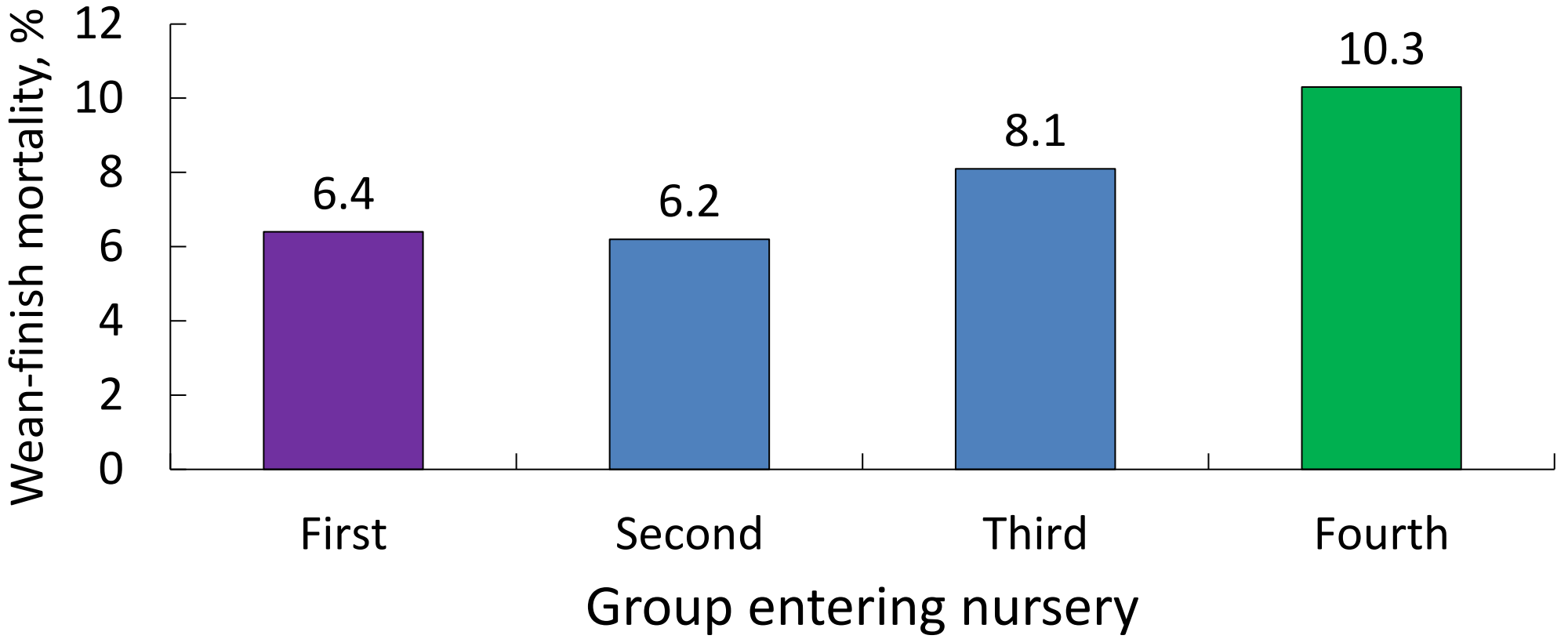
Influence of weaning age on need for injectable antibiotics



Slope = -3%

Faccin et al., 2020

Short fill time with as few of groups as possible



Faccin et al., 2020

Maintaining nutrient intake immediately after weaning to reduce mortality

- 2 literature reviews and 10 experiments using a total of 17,289 pigs.

Strategies to increase feed intake after weaning

Pre-weaning

Maternal nutrition
Management
Piglet nutrient intake

Post-weaning

Environment
Placement strategies
Nutrient availability
Genetics

Maintaining continuity of nutrient intake after weaning. I. Review of pre-weaning strategies

Madie R. Wensley[†,1], Mike D. Tokach[†], Jason C. Woodworth[†], Robert D. Goodband[†], Jordan T. Gebhardt[‡], Joel M. DeRouchey[†], and Denny McKilligan[‖]

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doi: 10.1093/tas/txa021

Maintaining continuity of nutrient intake after weaning. II. Review of post-weaning strategies

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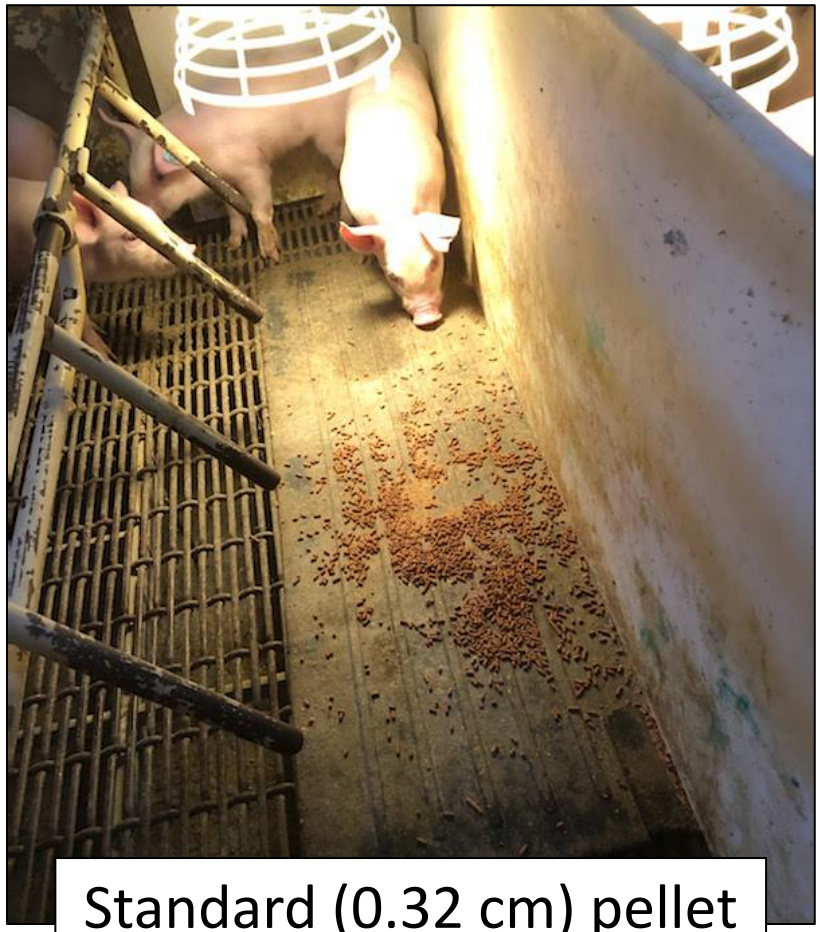
doi: 10.1093/tas/txa022

Floor feeding creep feed

264 litters corresponding with 2,497 nursery pigs – no creep or 227 g/d

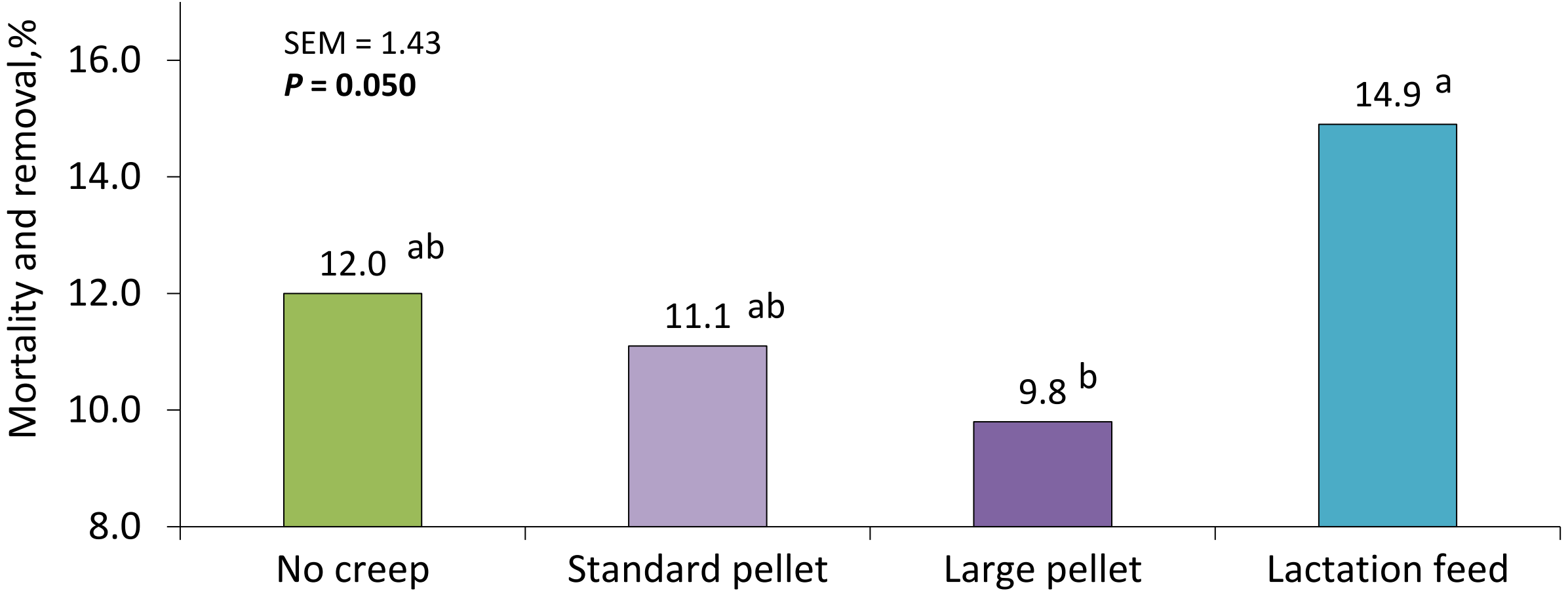


Standard (0.32 cm) pellet

Large (1.27 cm) pellet

Lactation meal feed

Influence of creep feed on mortality and removals



Wensley et al., 2022

Influence of creep feed on growth performance, d 0 to 36

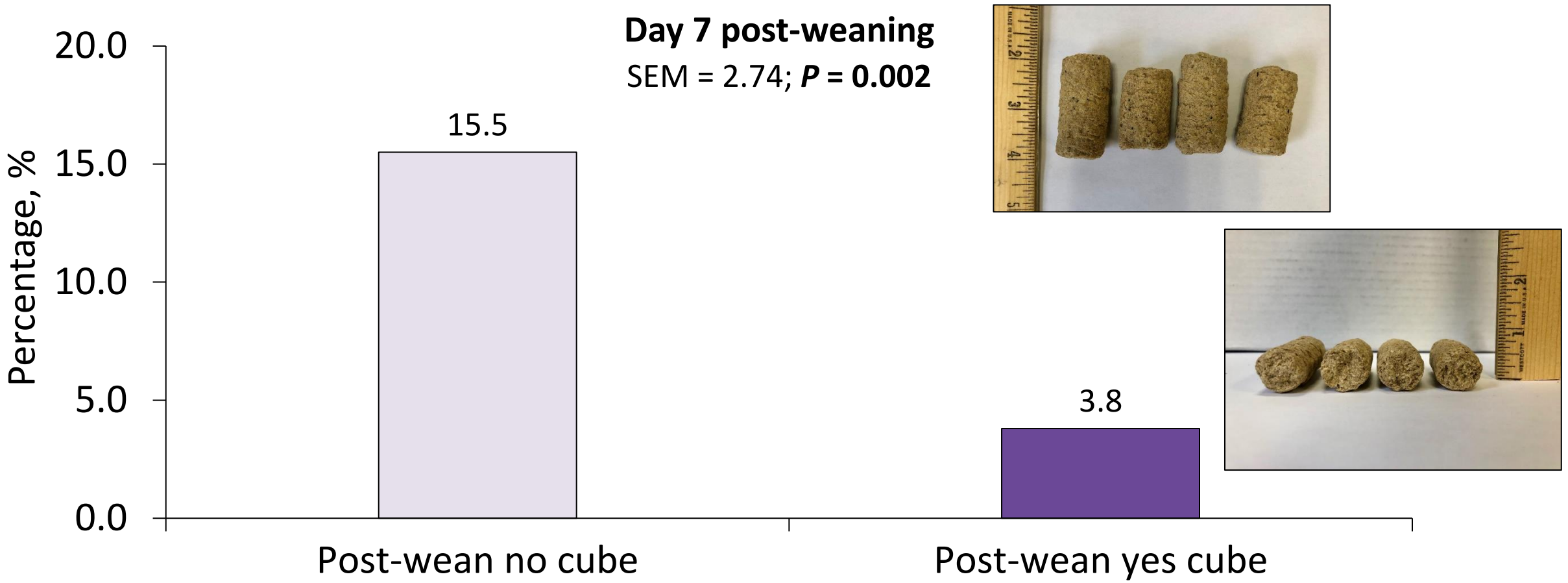
per pig placed

Wensley et al., 2022

Sensory attractants

- 3 experiment using a total of of 84 litters and 1,066 nursery pigs
  - $2 \times 2 \times 2$ factorial, main effects of pre-weaning attractant, post-weaning attractant, and BW category
    - **Exp. 1:** Enrichment cubes – play/foraging behavior
      - 100 g of cubes once daily for 4 d preweaning and 3 d postweaning
    - **Exp. 2:** Restart AFP (powder) – olfactory/taste
      - 45 g of powder twice daily for 4 d preweaning and 22.5 g twice daily for 3 d postweaning
    - **Exp. 3:** Pro2Lyte (spray) - olfactory/taste
      - 44 mL twice daily for 2 d post-farrowing and 2 d preweaning and 18 mL three times daily for 3 d postweaning

Exp. 1 Enrichment cubes after weaning on body weight loss in early nursery



Wensley et al., 2022

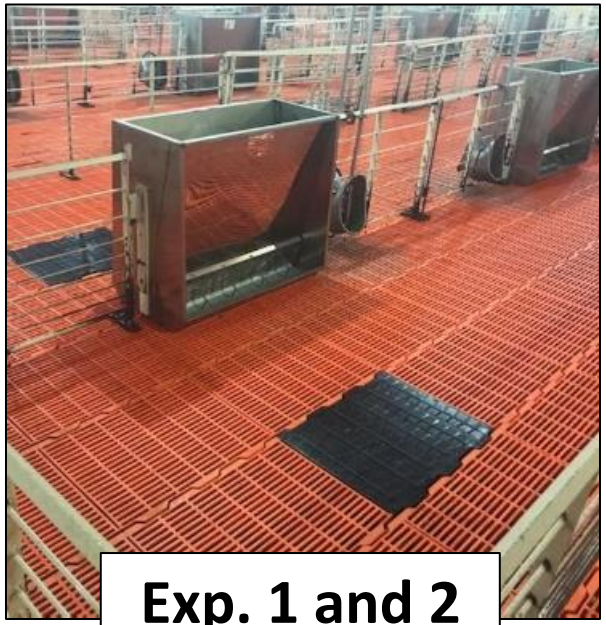
Mat feeding strategies

- 3 experiments using a total of 9,403 nursery pigs
- 30 to 35 pigs per pen
  - **Exp. 1:** mat v no mat feeding
  - **Exp. 2:** 2 × 2 factorial with main effects of diet form (pellet or crumble) and mat feeding (without or with)
  - **Exp. 3:** mat feeding small (0.32 cm) or large (1.27 cm) pellets, or no mat feeding

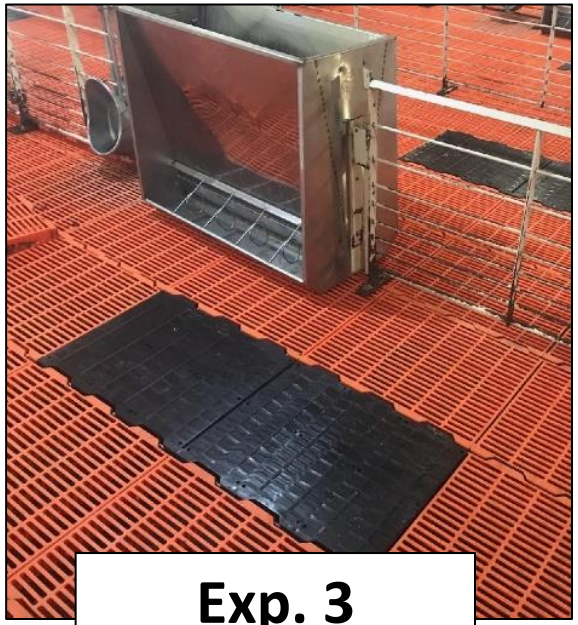
Wensley et al., 2022

Mat feeding strategies

- Feed was provided on 46 cm × 61 cm pieces of DuraTuff solid flooring three times daily for 10 d post-placement.
  - **Exp. 1:** 318 g of pelleted feed
  - **Exp. 2:** 318 g of pelleted or 372 g of crumble feed
  - **Exp. 3**: 726 g of pelleted feed

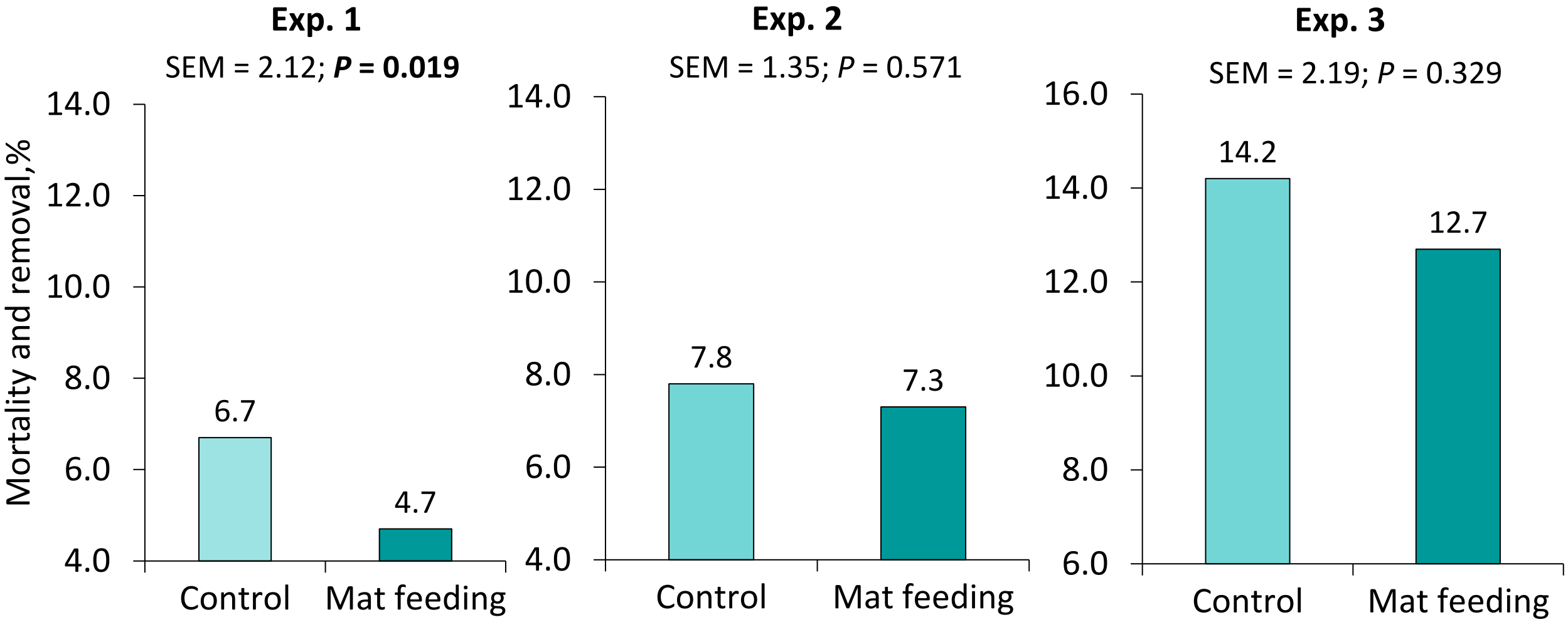


Exp. 1 and 2



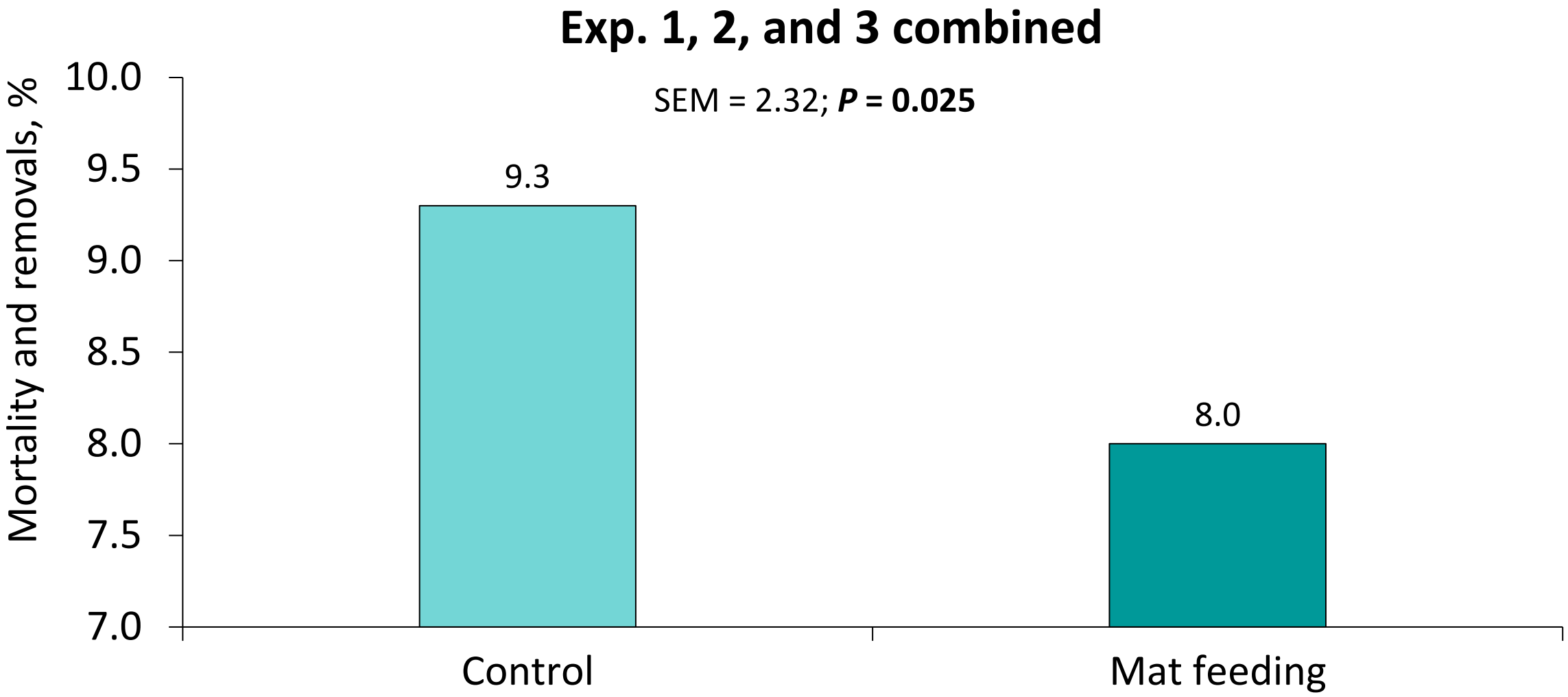
Exp. 3

Mortality and removals



Wensley et al., 2022

Mortality and removals



Wensley et al., 2022

Field trials and demonstrations with attempts to increase early nursery feed intake to reduce mortality…

Implementation of feeding and management strategies (creep feeding, mat feeding, gruel feeding, use of sensory attractants)

- Can successfully…
  - reduce the percentage of pigs that lose weight after weaning
  - reduce morbidity and mortality rates in the nursery
  - increase animal caretaker involvement
- Have limited effects on nursery pig growth performance
  - because of innately LOW feed intake
  - exception = genetic selection

Health status plays a critical role on the outcome.

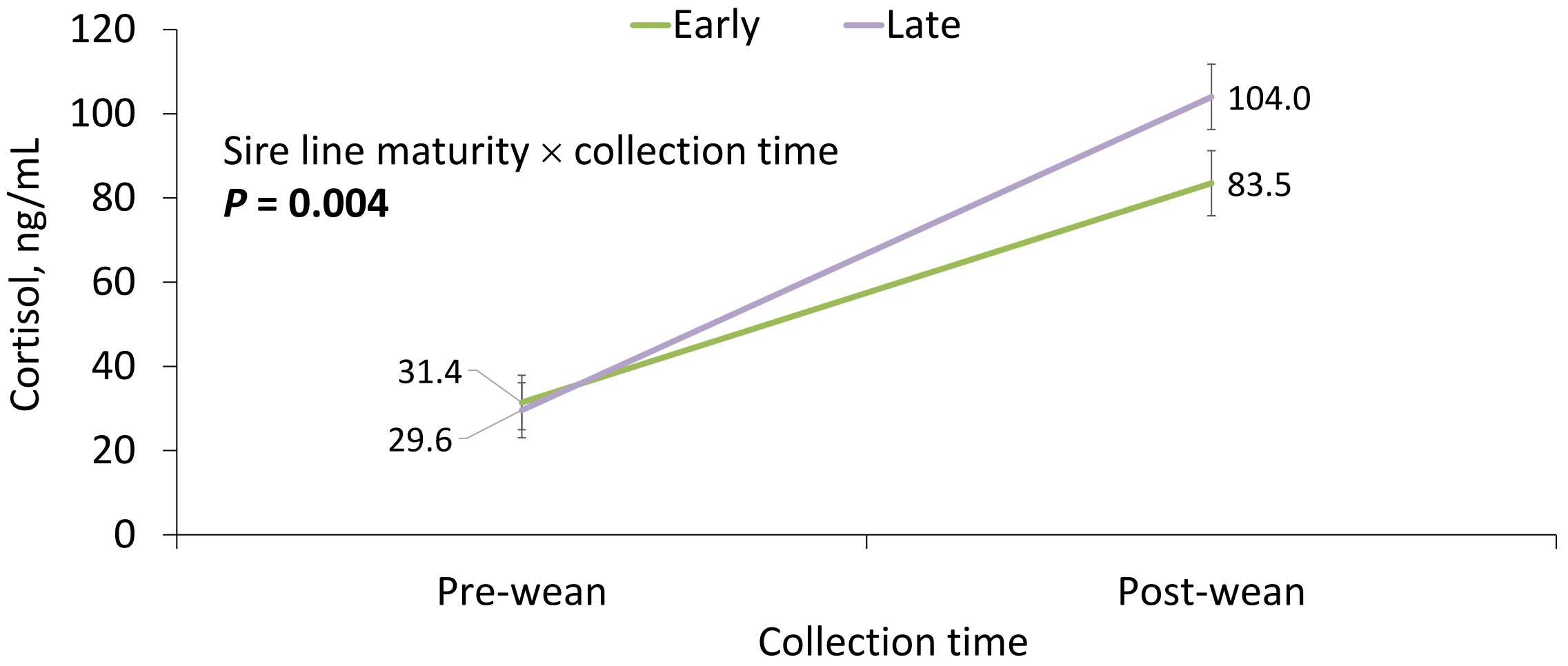
Wensley et al., 2022

Sire line maturity

- Sows were bred to 1 of 2 Duroc sire lines
  - Early maturing (high growth early)
  - Late maturing (high growth late)
- Pig growth performance was tracked from birth to market
  - Initial feed intake and body weight loss post-weaning
- Sire line stress response was determined at weaning
  - Blood cortisol

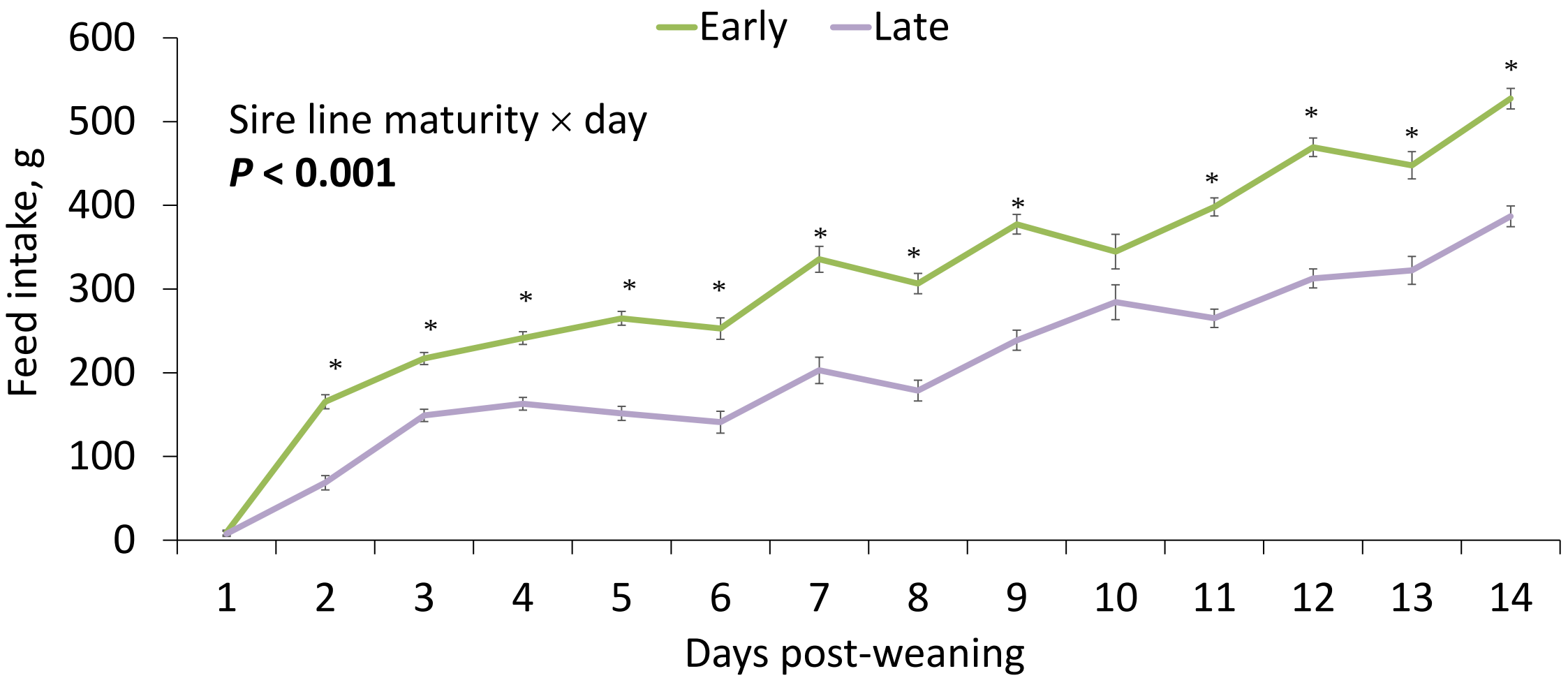
Wensley et al., 2022

Blood cortisol



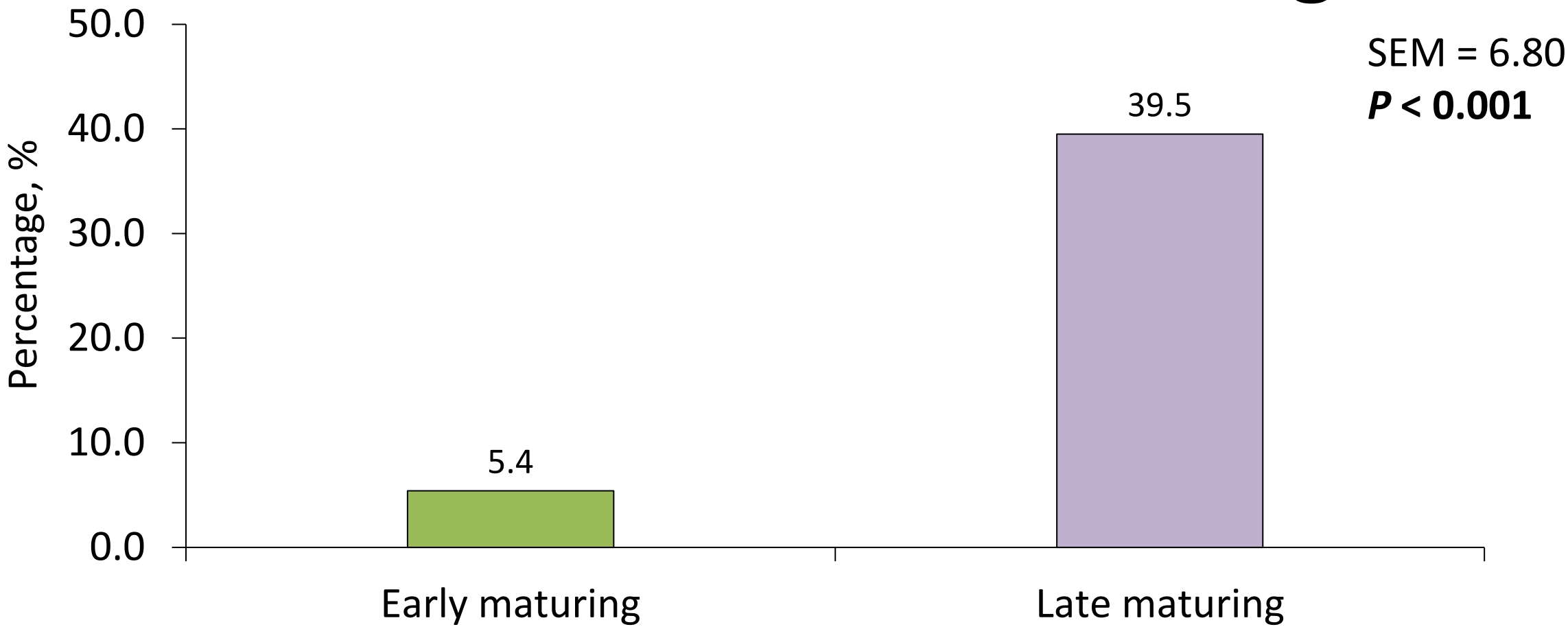
Wensley et al., 2022

Daily feed intake post-weaning



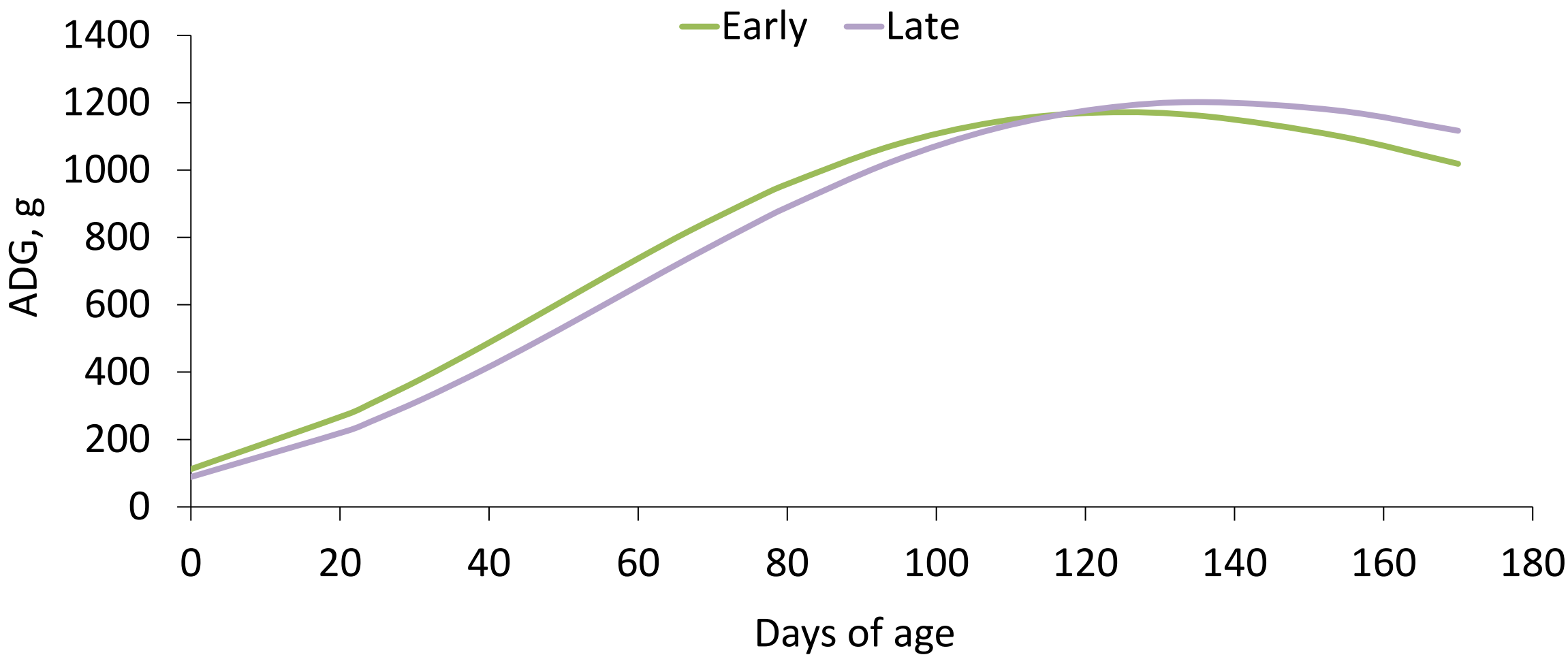
Wensley et al., 2022

Percentage of pigs that lost weight from d 0 to 3 after weaning



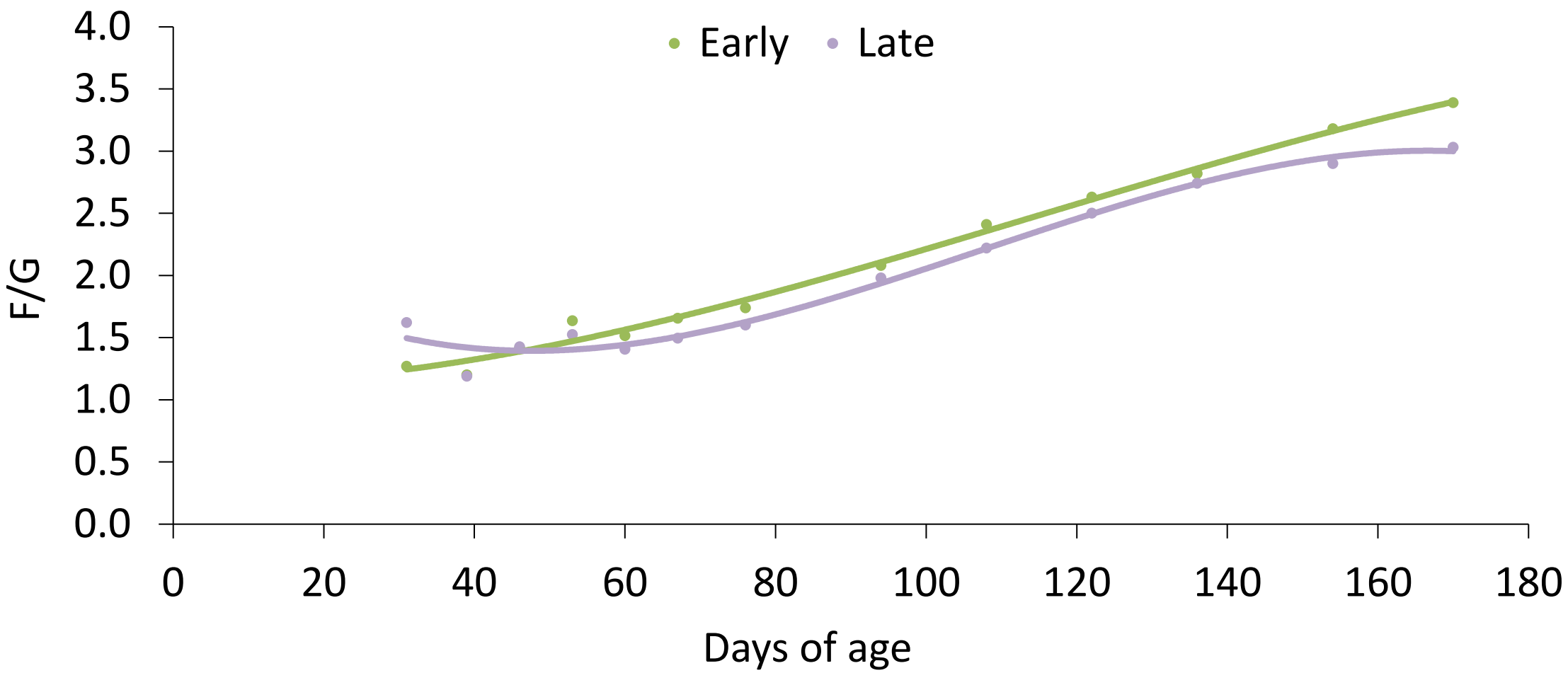
Wensley et al., 2022

Average daily gain



Wensley et al., 2022

Feed efficiency



Wensley et al., 2022

Summary

As part of the NPB Survivability Project, we have:

- Developed tools to determine economic cost of mortality
- Determined that factors before weaning are the main drivers of downstream mortality
  - Ex. Birth weight, weaning age and weight, colostrum intake, cross-fostering
- Found strategic management around weaning (mat feeding, creep feed, attractants, etc) can:
  - Reduce the percentage of pigs that lose weight after weaning
  - Reduce morbidity and mortality rates in the nursery
- Found that genetic selection plays a major role in stress response to weaning and nursery intake and growth

Wensley et al., 2022

Improving Pig Survivability

https://piglivability.org

FFAR

pork checkoff

Iowa Pork Industry Center

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