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The use of canola meal in dairy calf starters

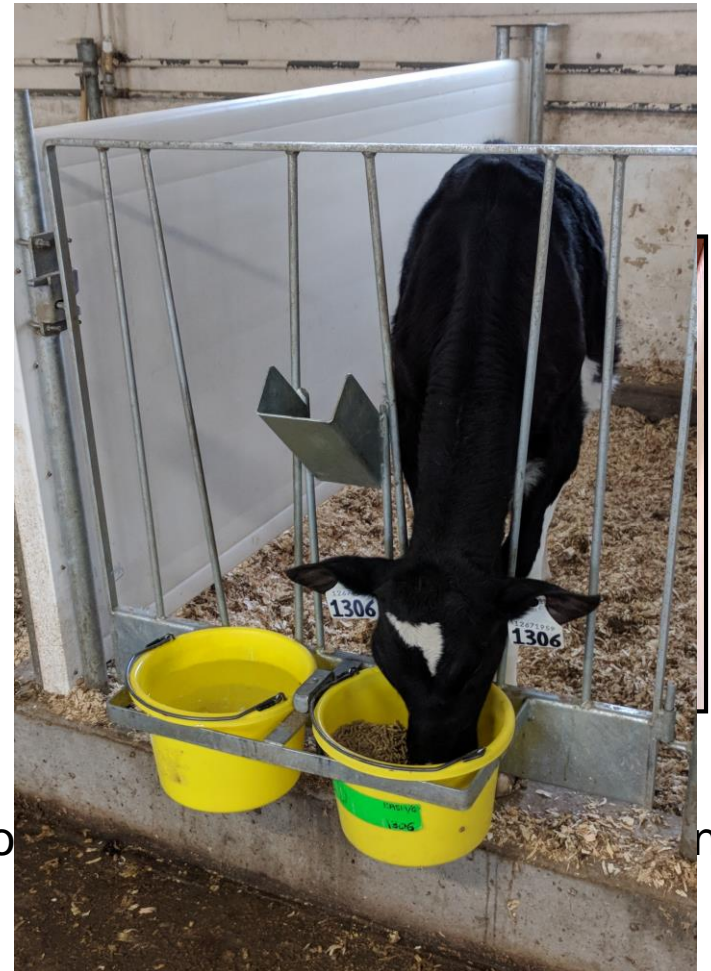
Dairy Info Day 2018

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Gastrointestinal tract (GIT) of calves



Abo

Canola meal

- Limited use of canola meal in starter mixture for dairy calves
- Low palatability
 - a) Bitter taste from sinapine and tannins
 - b) Breakdown products of glucosinolates (Fiems et al., 1985)
- Low digestibility (Khorasani et al., 1990)
 - a) High fibre content
 - b) Antinutritional factors
 - c) Decreased intestinal amino acid digestibility, except glutamic acid



Canola meal vs. soybean meal

	Canola meal	Soybean meal
Production (t)	5,150,000	1,452,000
Import (t)	24,600	756,500
Export (t)	4,680,000	261,920
Domestic utilization (t)	500,900	1,946,580
Price (CAD per t)	\$280	\$465
Price (CAD per t of protein)	\$718	\$989

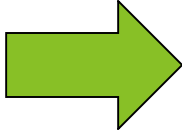
(2016-2017, (2016-2017,
Canola Council) Soy Canada)



Canola meal research at UofS

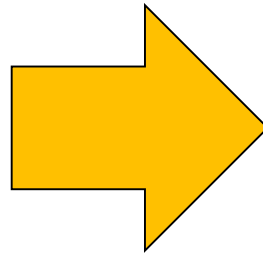
- Heat treatment of canola meal
- Canola meal vs. soybean meal comparison
- Optimal canola meal inclusion rate

Canola meal research at UofS

- **Heat treatment of canola meal** 
- Canola meal vs. soybean meal comparison
- Optimal canola meal inclusion rate

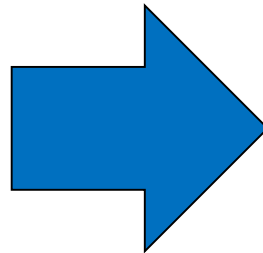
Heat Treated Canola Meal and Glycerol Supplementation

Heat treatment



Increase in by-pass protein
Enhanced small intestine
development
Inactivation of
antinutritional factors

Glycerol inclusion



Improved palatability
Higher feed intake
Higher ruminal butyrate
Stimulation of rumen
development

Heat treatment

Canola meal heated to 110°C in a tumble dryer (POS, Saskatoon) and held at the temperature for 10 min

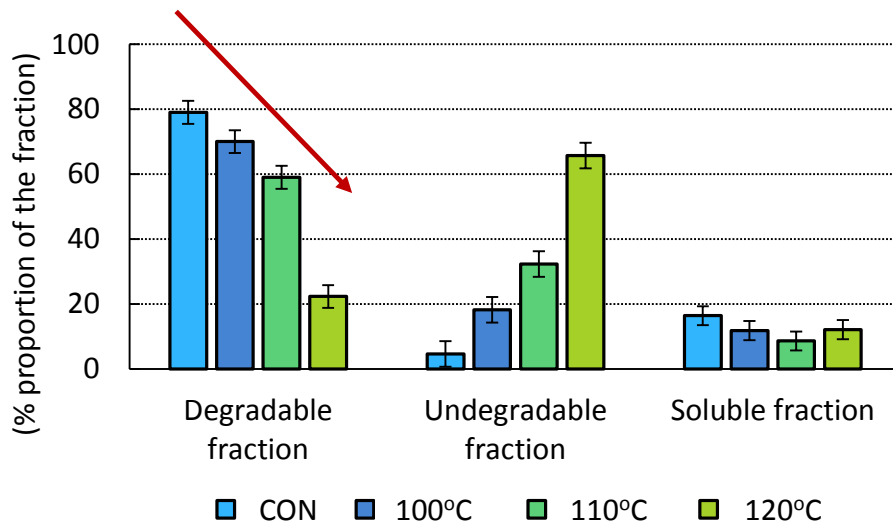


Figure 1. Crude protein rumen digestibility fractions

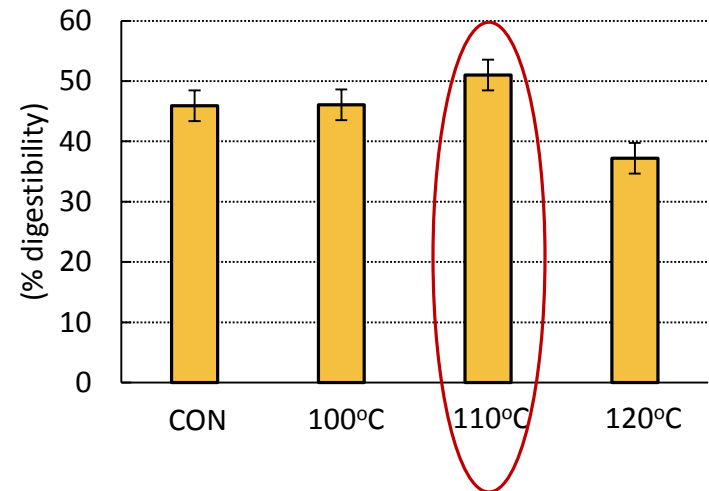


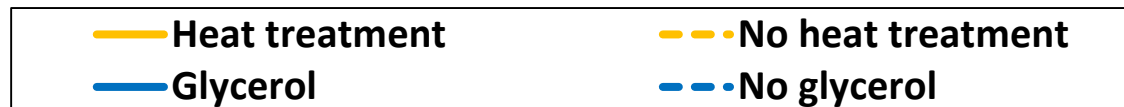
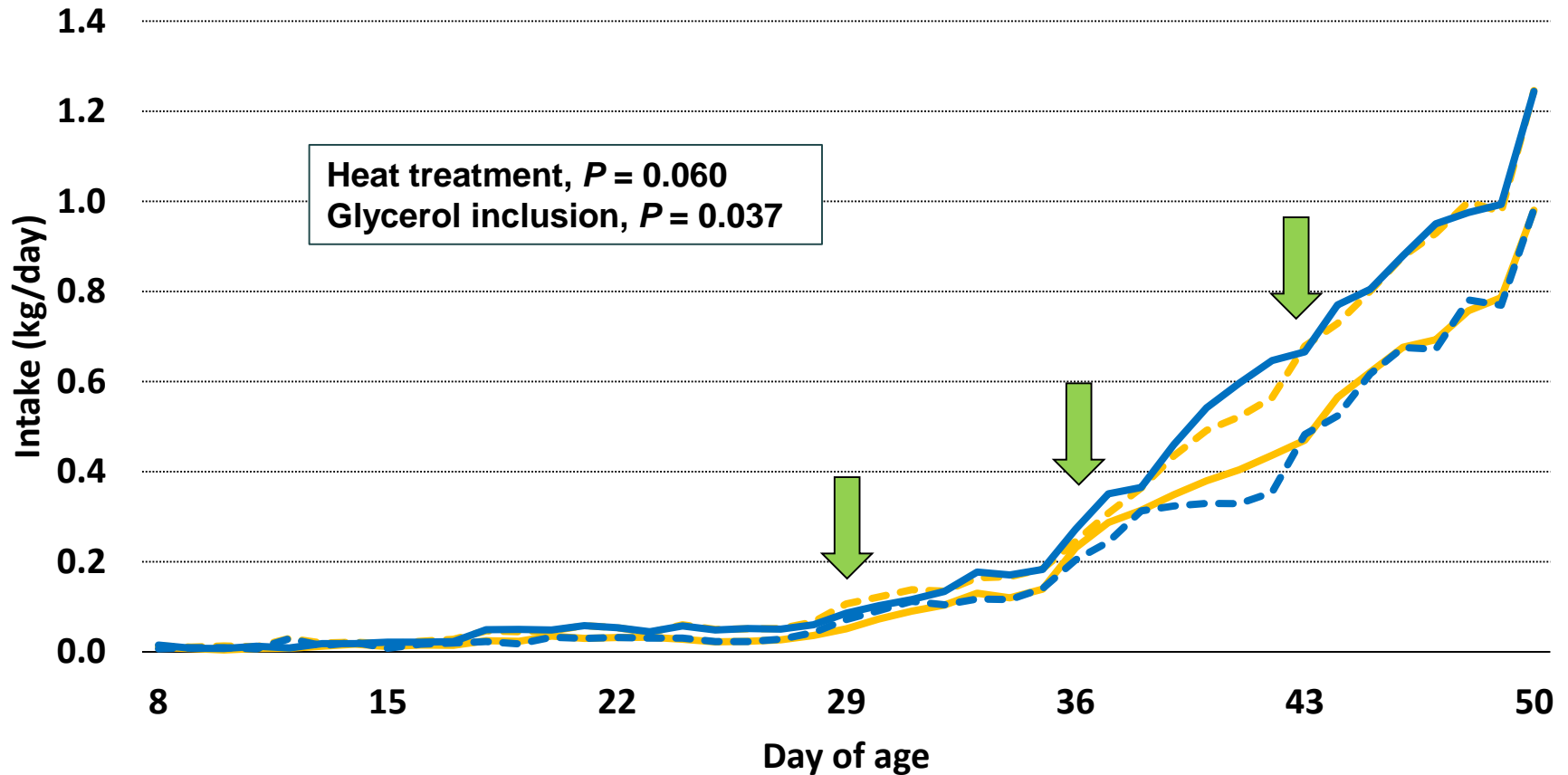
Figure 2. Estimated intestinal digestibility of crude protein

Materials and methods

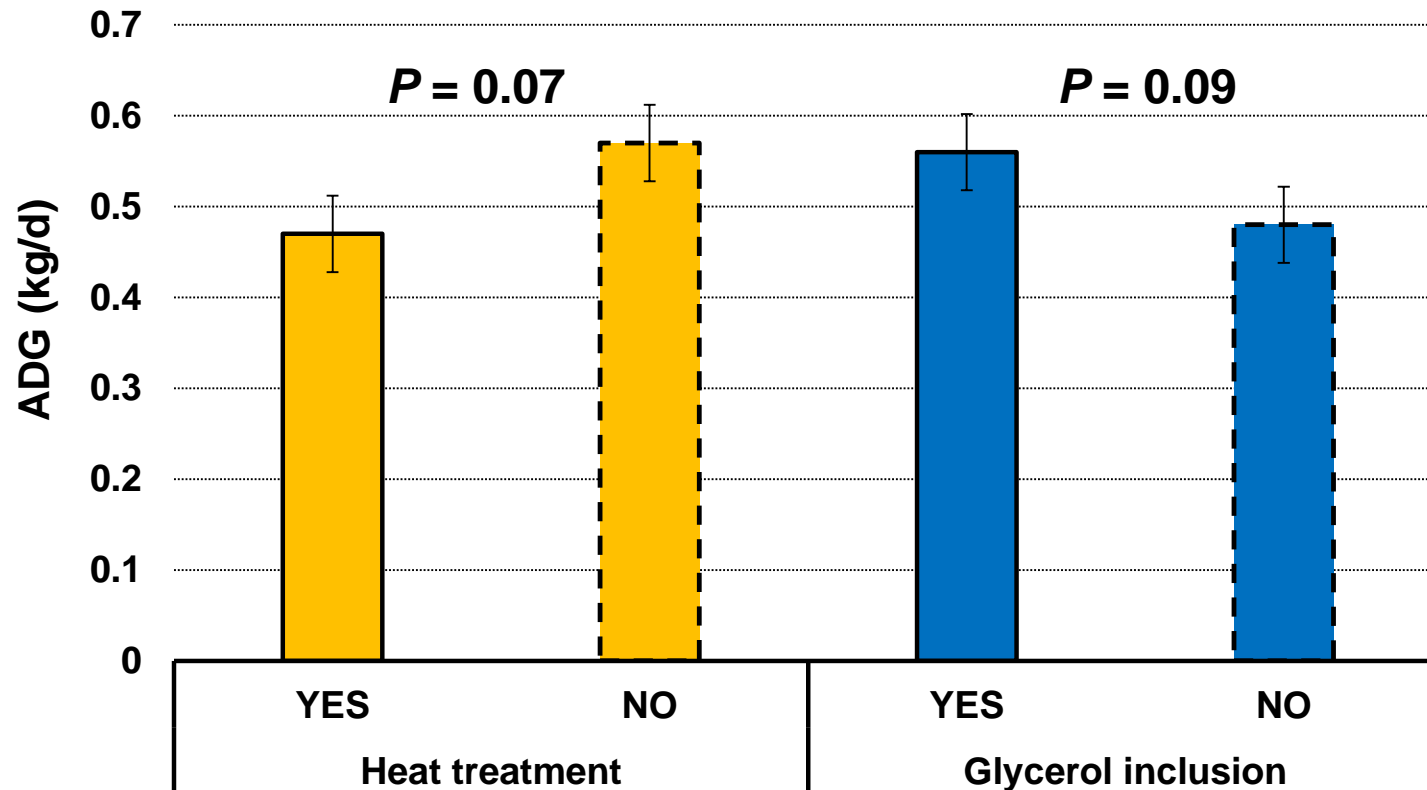
- 28 Holstein bull calves at 8 d of age
- Housed in Livestock Research Building at UofS
- Fed milk replacer for 49 d
- Starter mixture offered ad libitum
- Body weight recorded weekly
- Calves were killed at 51 d of age
- Dissection of gastro-intestinal tract



Starter intake



Average daily gain



- Milk replacer intake did not differ between treatments ($P \geq 0.21$)
- Body weight did not differ between treatments ($P \geq 0.47$)

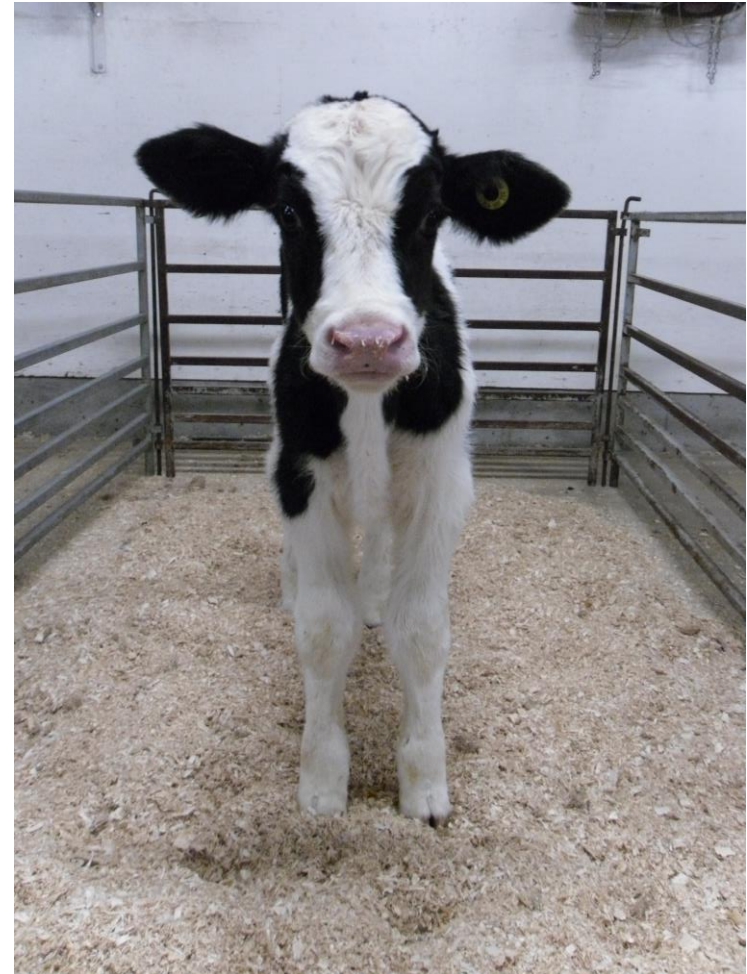
Summary of results

Canola meal heat treatment

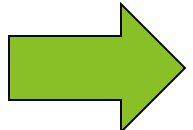
- ↓ Average daily gain
- ↓ Starter intake
- ↓ Rumen mass
- ↓ Small intestine mass and length

Glycerol inclusion

- ↑ Average daily gain
- ↑ Starter intake
- ↑ Small intestine mass
- ↑ Total ruminal SCFA
- ↓ Ruminal pH



Canola Meal Research at UofS

- Heat treatment of canola meal
- **Canola meal vs. soybean meal comparison** 
- Optimal canola meal inclusion rate

Materials and methods



Study 1

Bulls: $n = 28$

Assigned: 8.7 ± 0.8 d of age

Weaning at 51.7 ± 0.8 d of age

Killed at 72.1 ± 0.9 d of age

Dissection of gastrointestinal tract:

- Morphometric measurements
- Sample collection

Study 2

Heifers: $n = 60$

Assigned: 9.1 ± 0.8 d of age

Weaning at 59.1 ± 0.8 d of age

Starter offered ad libitum

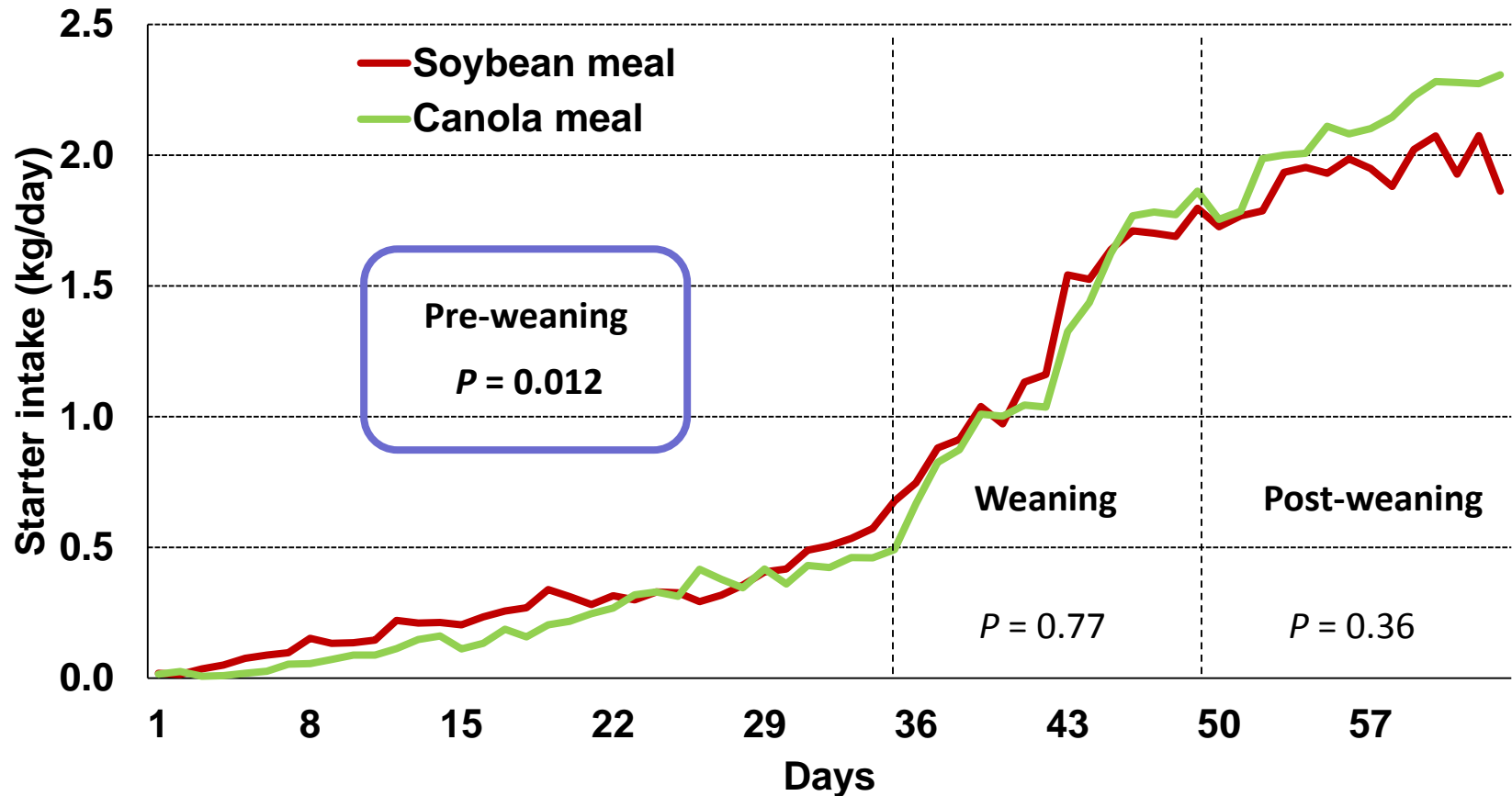
BW recorded weekly

Starter composition

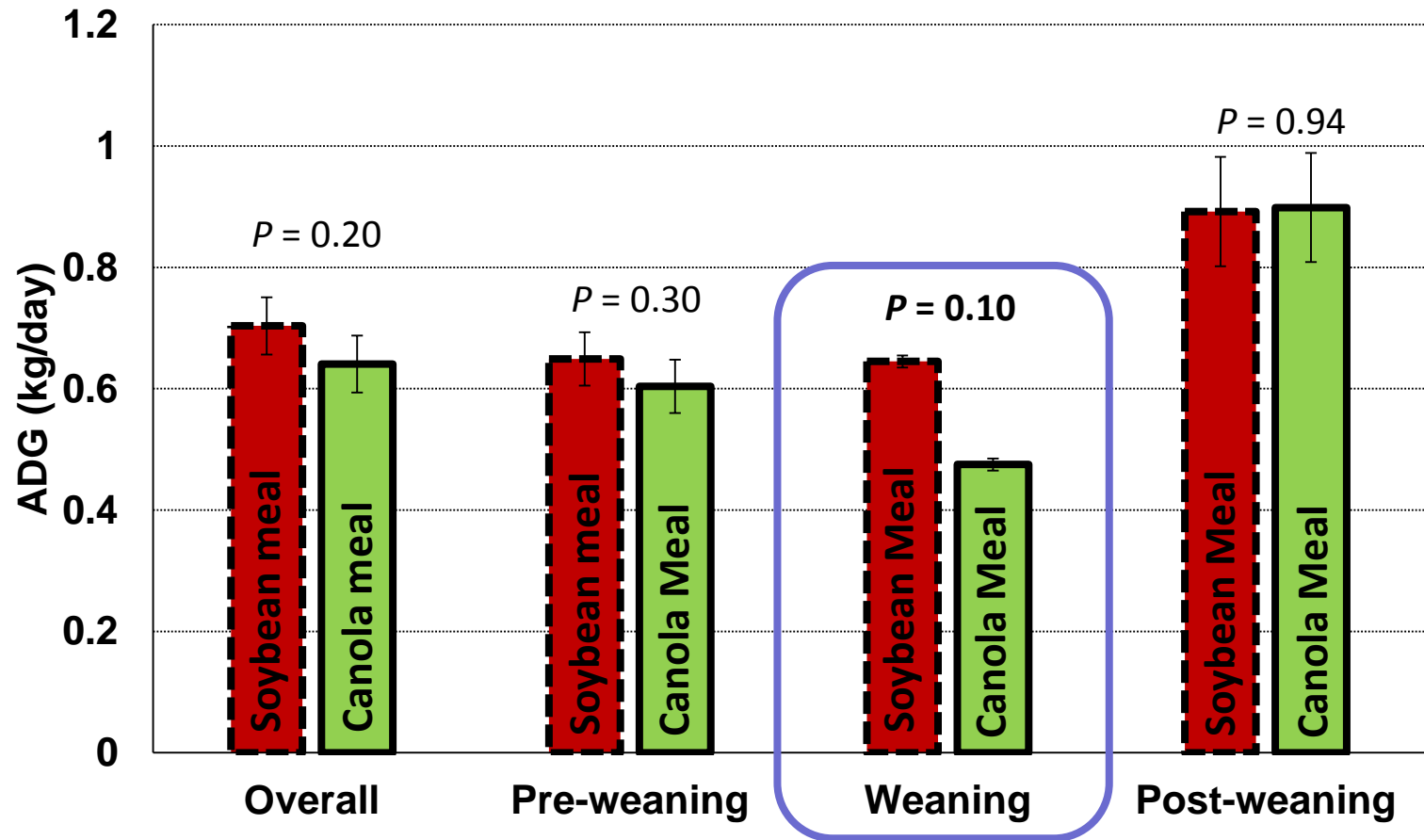
Component (% DM)	Soybean meal	Canola Meal
Soybean meal	24.2	0
Canola meal	0	35.2
Barley	28.9	18.9
Corn	29.3	29.3
Wheat bran	4.8	4.8
Methionine	0.06	0
Salt	0.5	0.5
Limestone	2.2	2.2
Mineral supplement	1.1	1.1
Whey protein (dry)	2.7	2.7
Glycerol	5.0	5.0
Monocalcium phosphate	1.1	1.1
Chromium oxide (III)	0.2	0.2
MSB	0	0



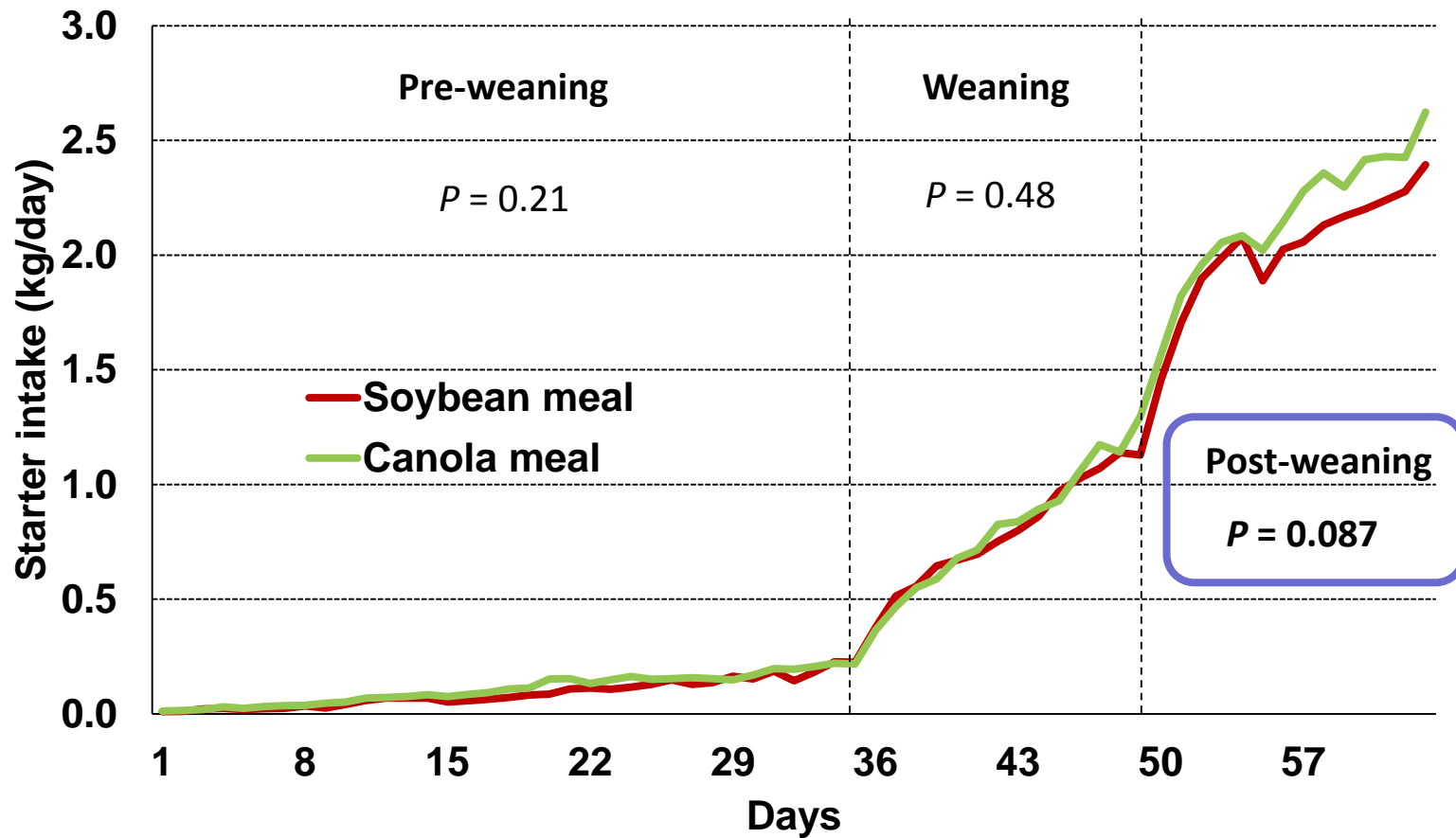
Bulls - starter intake



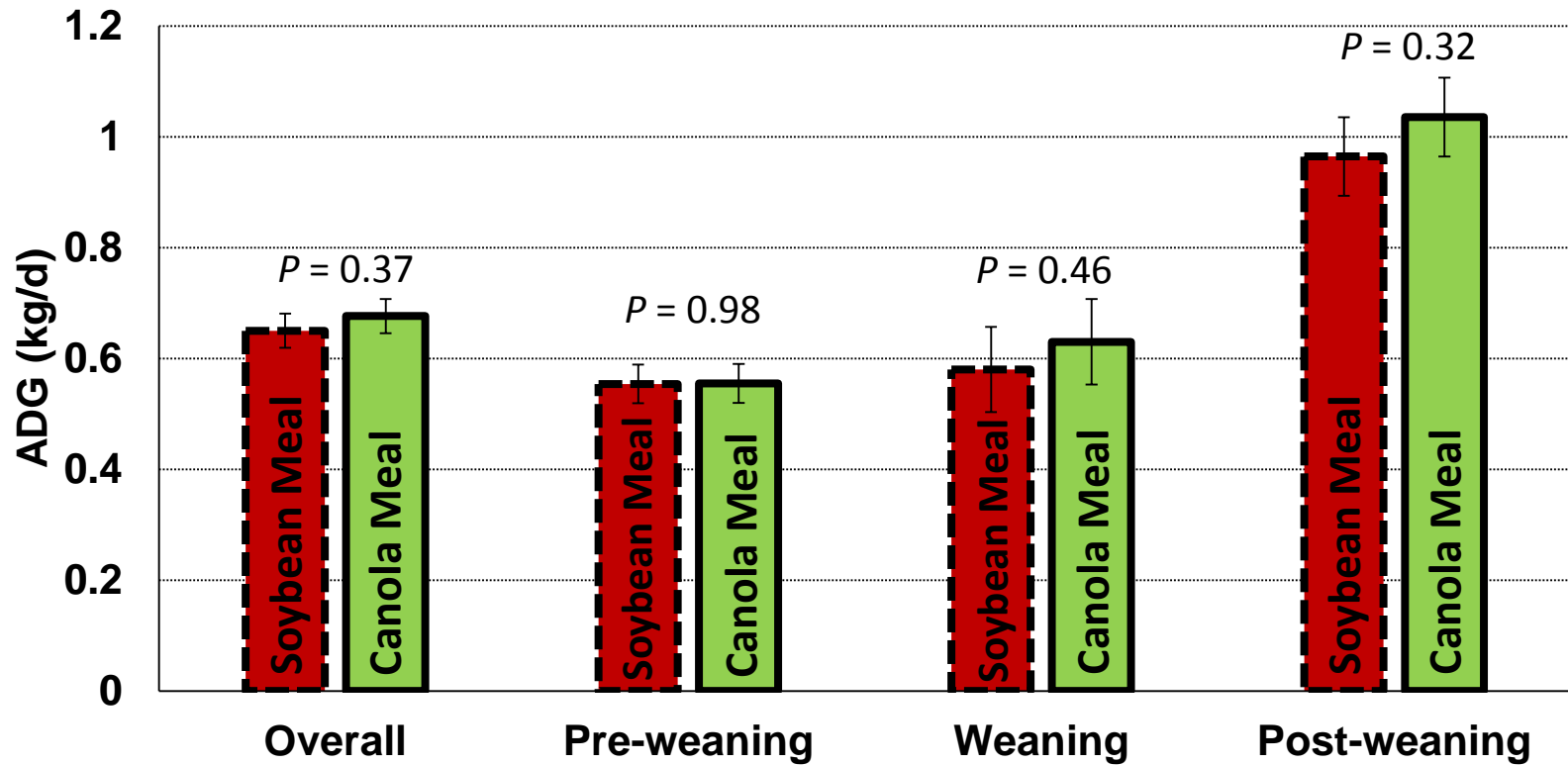
Bulls - average daily gain



Heifers – starter intake



Heifers – ADG



Results summary

Study 1 - Bulls

- ↑ SBM: pre-weaning starter intake
- ↑ SBM: weaning ADG
- ↑ SBM: ammonia concentration in rumen fluid
- ↑ CM: small intestine weight and length

Study 2 - Heifers

- = Protein source: no difference in ADG
- ↑ CM: starter intake post-weaning

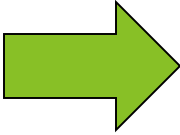


Study by Hadam et al., 2016

- ↓ CM: Overall and pre-weaning ADG
- ↓ CM: Overall and pre-weaning feed efficiency
- ↑ CM: Pre-weaning fecal fluidity and diarrhea
- = Feeding behaviour and performance during weaning transition



Canola Meal Research at UofS

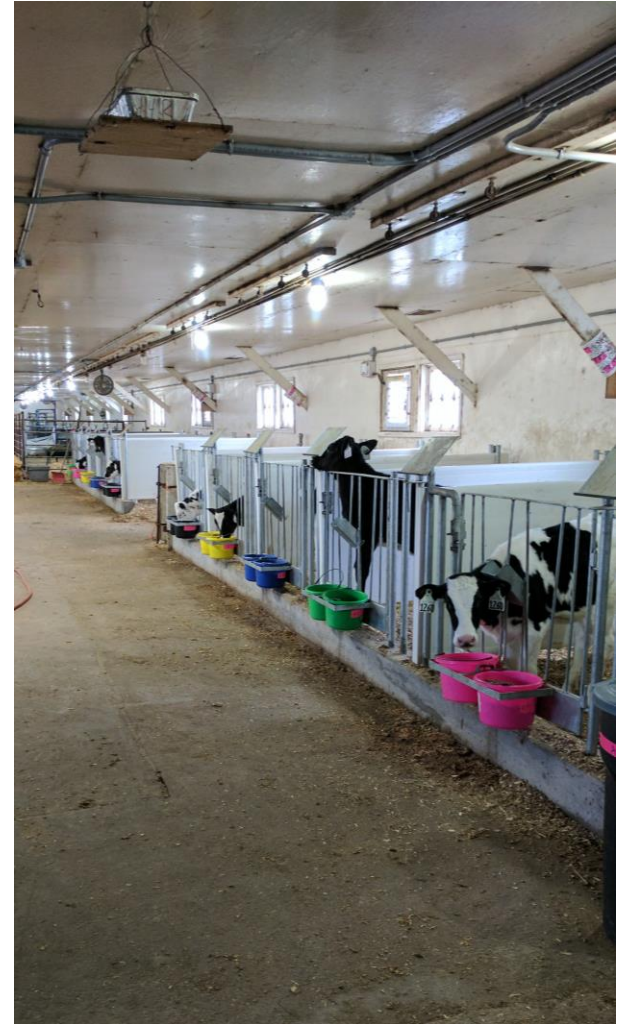
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Optimal Canola Meal Inclusion Rate

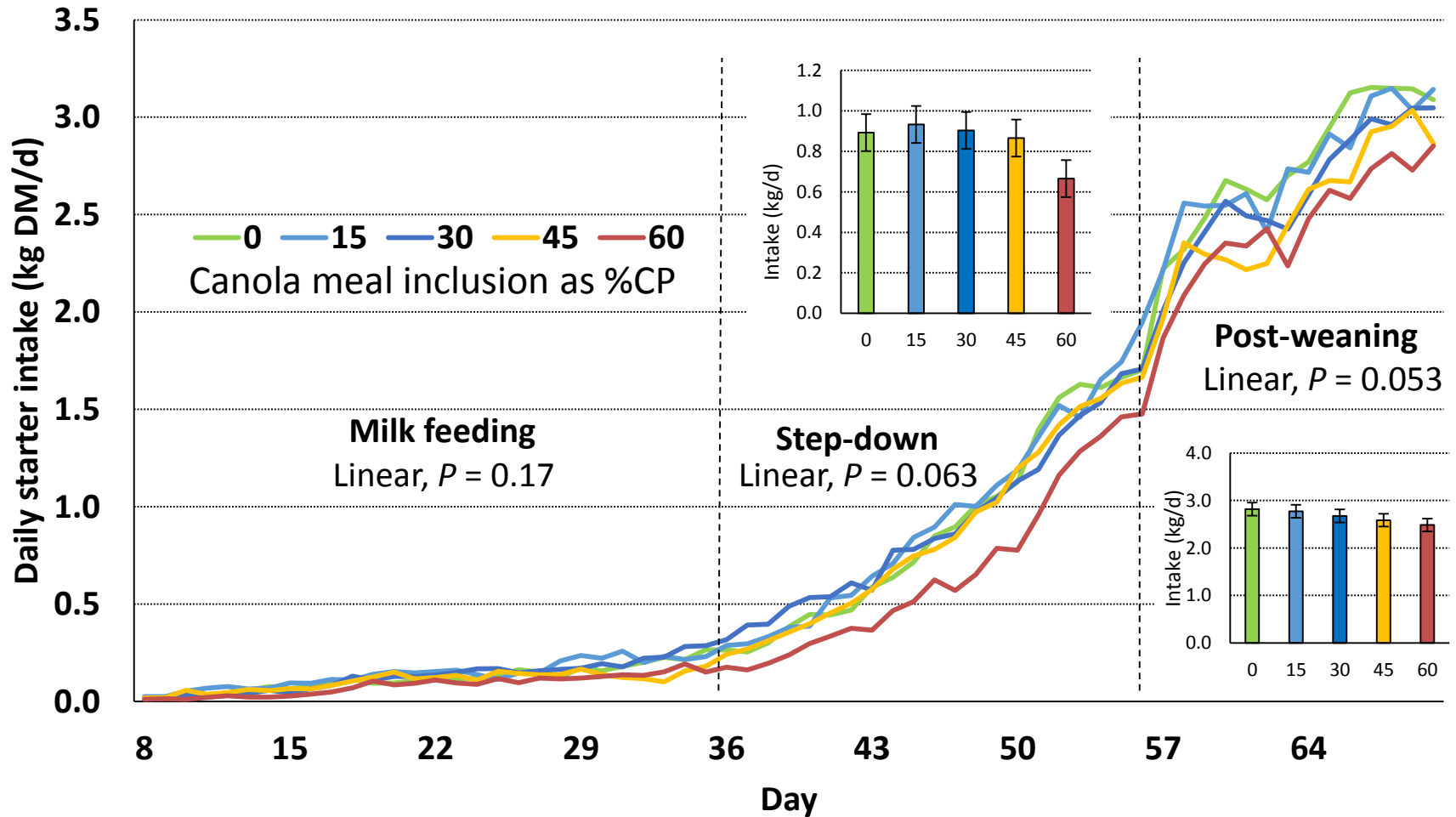
Components (% DM)	CM inclusion as % of CP				
	0	15	30	45	60
Barley	15.8	17.7	18.0	18.7	20.7
Corn	21.8	21.4	22.3	22.8	22.5
Corn gluten meal	1.0	1.5	2.0	2.5	3.0
Wheat bran	21.1	18.1	15.7	12.7	9.8
Soybean meal	28.4	24.1	19.8	15.7	11.4
Canola meal	0.0	5.2	10.4	15.7	20.7
Salt	0.5	0.5	0.5	0.5	0.5
Limestone	2.2	2.2	2.2	2.2	2.2
Molasses	2.2	2.2	2.2	2.2	2.2
Mineral supplement	1.1	1.1	1.1	1.1	1.1
Whey protein	2.6	2.6	2.6	2.6	2.6
Glycerol	2.5	2.5	2.5	2.5	2.5
Monocalcium phosphate	0.6	0.6	0.6	0.6	0.6
Titanium oxide	0.2	0.2	0.2	0.2	0.2

Materials and methods

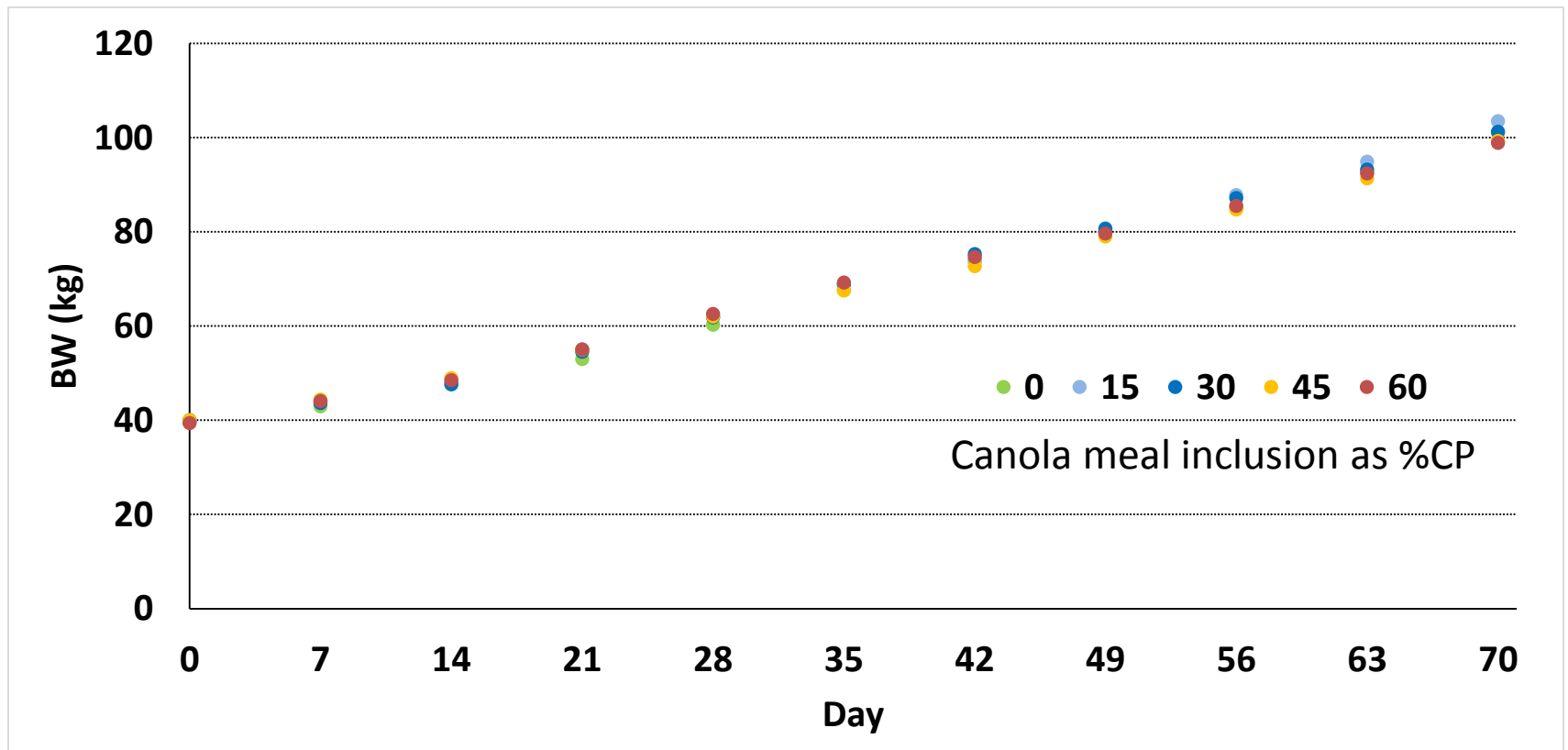
- Holstein heifer calves n=50
- Rayner Dairy Research & Teaching Facility
- Housed in individual pens in the calf barn
- Weaning at 57 d of age
- Fed starter from 8 d of age until end of study at 71 d of age
- Intake recorded daily
- BW recorded weekly



Starter intake

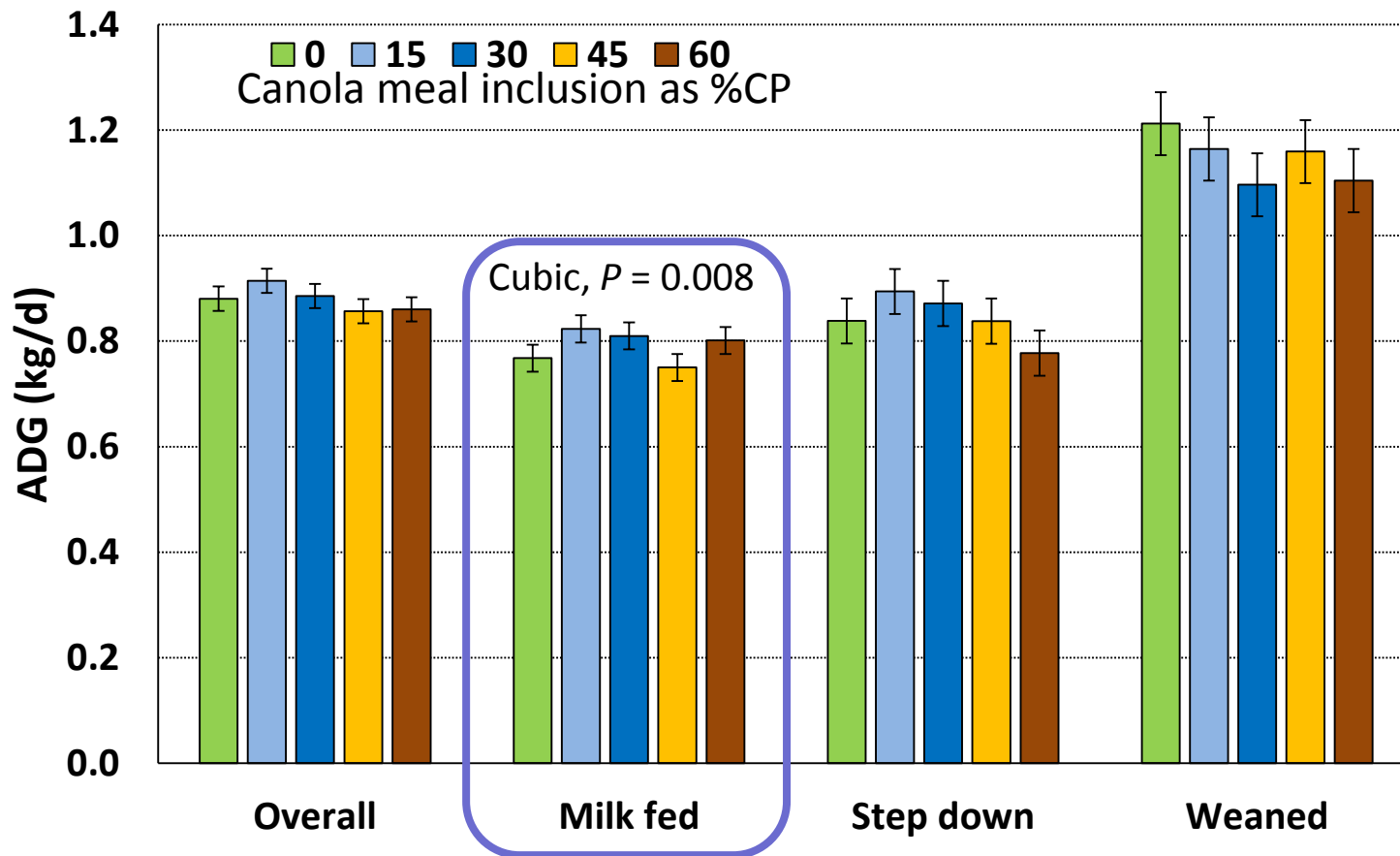


Body weight

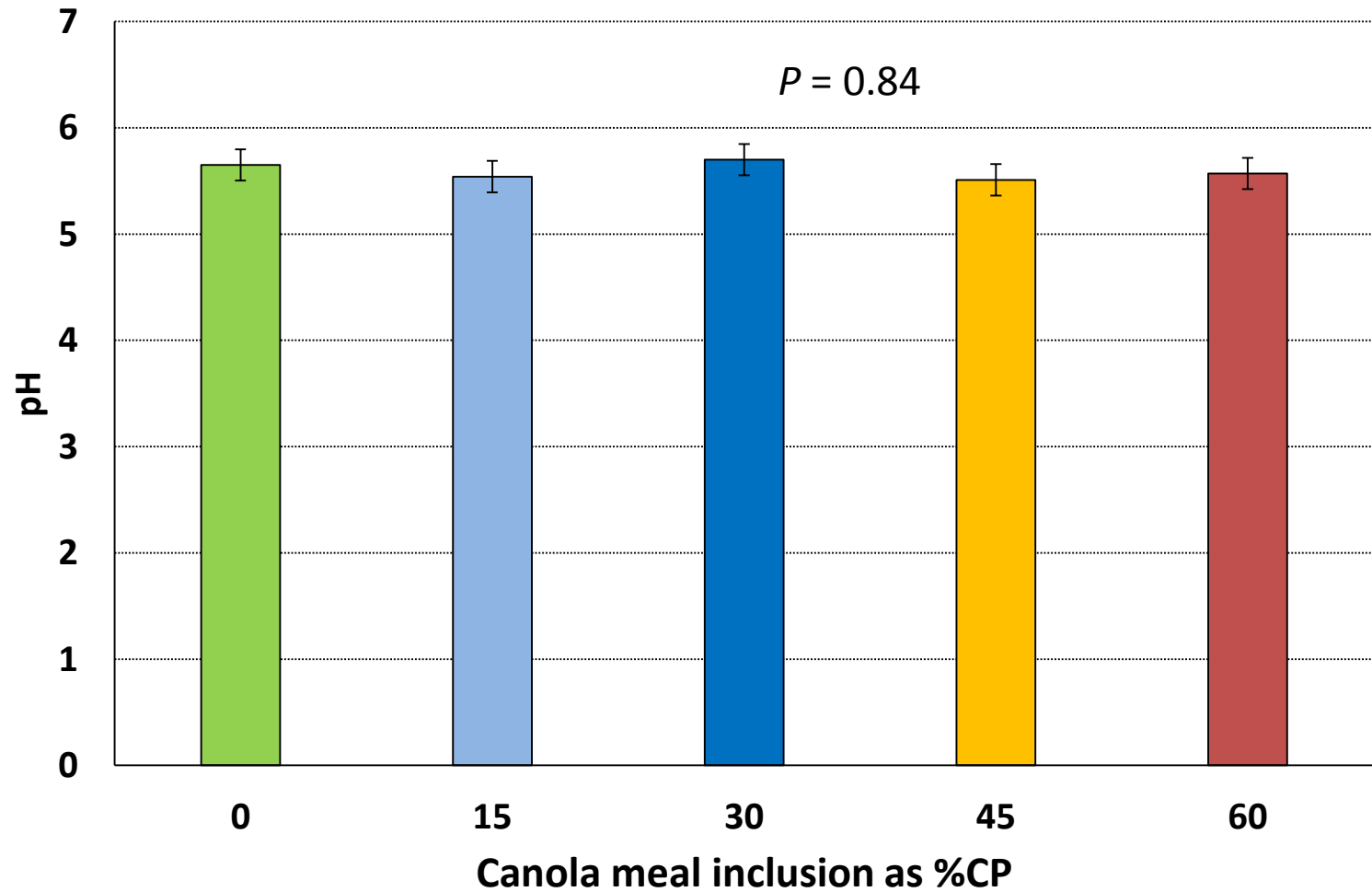


- Initial body weight $P = 0.99$
- Final body weight $P = 0.66$
- Feed efficiency $P = 0.86$

Average daily gain

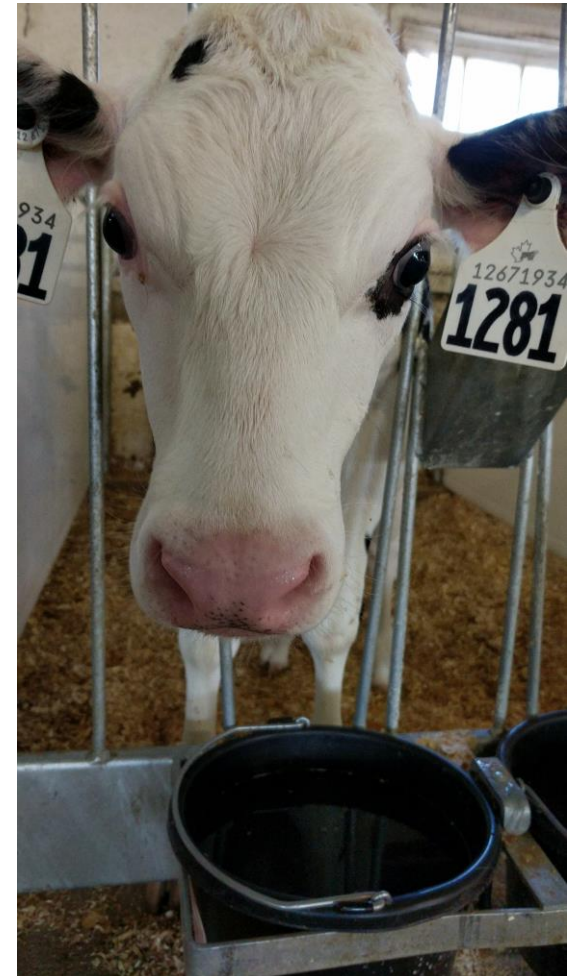


Rumen fluid - pH



Take home messages

- Canola meal can be used as a partial replacement (45 – 50% CP) for soybean meal in calf starters
- Canola meal can be used in the calf starters to optimize starter cost
- Over-heating of canola meal can negatively impact starter intake and ADG



Acknowledgments

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Sask **milk**

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- Staff and colleagues from University of Agriculture in Kraków and University of Saskatchewan



University of Agriculture
in Krakow



Thank you



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