

## Relationships between protein and energy consumed from milk replacer and starter and calf growth and first lactation production performance of Holstein dairy cows

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## Objective

- Determine the relationships between protein and energy (ME) consumed from milk replacer and starter and first lactation performance of Holstein dairy cows
- Merging data from 45 studies across 10 years for a multiple study analysis should improve our understanding of the effects of early life protein and energy consumed and first-lactation performance

## SROC Calf and Heifer Research Facility



- Heifer calves from 3 commercial dairies



## Data for study

- Data were collected from birth year of 2004 to 2014 for 4,534 Holstein animals
- Lactation data was analyzed for 3,627 animals. Lactation data was from 2006 to 2017
- Data used in this study was from the first 60 days of life. Calves remained at SROC for another 3 to 4 months and then either returned to their home farm or a commercial grower.

## Data for Study, continued



- Body weights (BW) were taken on arrival and d 14, 28, 42, 49, 56 and when leaving SROC
- Health treatments were recorded for each calf

## Data for Study, continued



- Starter and water were offered in open pails.
- Amounts of milk replacer and starter offered and refused were recorded daily
- Health treatments were recorded for each calf

## Data for Study, continued

- All farms on DHIA (DRMS, Raleigh NC)
- First lactation data collected from monthly tests
  - Actual 305 d milk
  - Milk protein and fat yield and concentrations

## Calf data analysis

- Milk Replacers
  - 20 to 28% Protein, majority were 20-20 milk replacer
- Starter was a commercial texturized starter
  - Majority were 18% Protein, but varied from 18 to 22% for a few studies
- ME of Milk Replacer and Starter were calculated using NRC formulas
- Calf protein and ME requirements were from the 2001 Dairy NRC

## Calf Data Analysis, continued

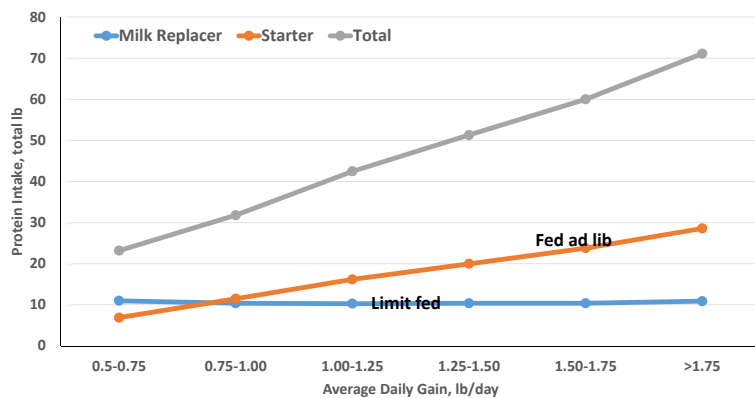
- Formulas (NRC, 2001):
  - $ME \text{ (Mcal/kg)} = 0.1 LW^{0.75} + (0.84 LW^{0.355} \times LWG^{1.2})$
- ME Content of MR:
  - $ME \text{ (Mcal/kg)} = [0.057 \times CP \text{ (\%)} + 0.092 \times Fat \text{ (\%)} + 0.0395 \times Lactose \text{ (\%)}] \times 0.9312$

## ADG Class at 8 wk for Milk Replacer and Starter Protein Intake (lb)

ADG (lb/d)	0.50-0.75	0.75-1.0	1.0-1.25	1.25-1.50	1.50-1.75	>1.75
Accumulative protein intake (lb) over 8 wk, LS Means						
Milk Replacer Protein	11.02 <sup>a</sup>	10.41 <sup>bc</sup>	10.32 <sup>c</sup>	10.41 <sup>bc</sup>	10.45 <sup>b</sup>	10.90 <sup>a</sup>
Starter Protein	6.90 <sup>f</sup>	11.53 <sup>e</sup>	16.18 <sup>d</sup>	19.97 <sup>c</sup>	23.85 <sup>b</sup>	28.64 <sup>b</sup>
Combined Protein	23.15 <sup>f</sup>	31.81 <sup>e</sup>	42.50 <sup>d</sup>	51.30 <sup>c</sup>	60.00 <sup>b</sup>	71.10 <sup>a</sup>

<sup>abc</sup> Values in the same row with different superscripts are different ( $P < 0.05$ )

## Effect of Protein Intake on ADG

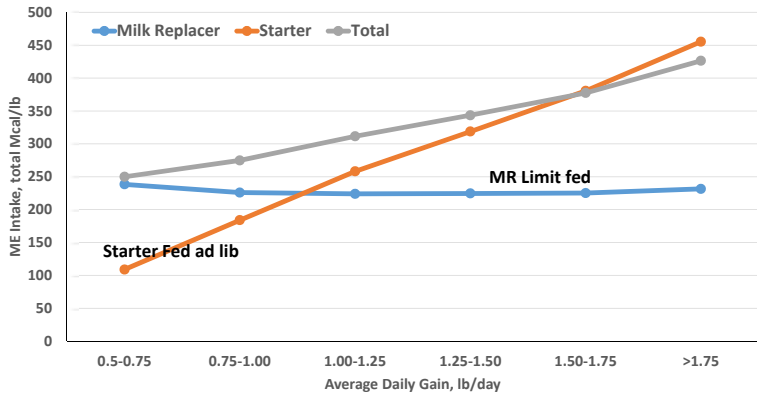


## ADG Class at 8 wk for Milk Replacer and Starter ME Intake (Mcal/lb)

ADG (lb/d)	0.50-0.75	0.75-1.00	1.00-1.25	1.25-1.50	1.50-1.75	>1.75
Accumulative ME Intake (Mcal/lb) over 8 wk, LS Means						
Milk Replacer ME	238.45 <sup>a</sup>	225.95 <sup>c</sup>	223.9 <sup>c</sup>	224.61 <sup>c</sup>	225.22 <sup>c</sup>	231.59 <sup>b</sup>
Starter ME	109.02 <sup>f</sup>	184.03 <sup>e</sup>	258.16 <sup>d</sup>	318.85 <sup>c</sup>	380.44 <sup>b</sup>	455.1 <sup>a</sup>
Combined ME	250.04 <sup>f</sup>	274.89 <sup>e</sup>	311.56 <sup>d</sup>	343.41 <sup>c</sup>	377.50 <sup>b</sup>	426.20 <sup>a</sup>

<sup>abc</sup> Values in the same row with different superscripts are different ( $P < 0.05$ )

### Effect of ME Intake on ADG



### Calf Milk Replacer and Starter Protein Intake (lb) at 8 wk to predict first-lactation 305-d milk yield

Variable	Week	Milk Replacer Protein (lb)		Starter Protein (lb)		Combined Protein (lb)	
		Estimate	P-value	Estimate	P-value	Estimate	P-value
305-d milk	8	76.3	0.27	50.5	0.06	24.96	0.03
305-d fat	8	3.09	0.34	2.89	0.004	1.19	0.006
305-d protein	8	1.52	0.48	2.91	<0.001	1.30	<0.001

### Calf Milk Replacer and Starter ME Intake (Mcal/lb) at 8 wk to predict first-lactation 305-d milk yield

Variable	Week	Milk Replacer ME (Mcal/lb)		Starter ME (Mcal/lb)		Combined ME (Mcal/lb)	
		Estimate	P-value	Estimate	P-value	Estimate	P-value
305-d milk	8	8.00	0.12	3.15	0.06	3.97	0.02
305-d fat	8	0.33	0.14	0.18	0.01	0.20	0.001
305-d protein	8	0.20	0.20	0.18	<0.001	0.20	<0.001

### Effect of birth season on 8 wk milk replacer and starter protein intake (lb), and milk replacer and starter ME (Mcal/lb)

	Spring	Summer	Fall	Winter
----- Protein Intake, lb -----				
Milk Replacer	10.71 <sup>ab</sup>	10.69 <sup>ab</sup>	10.52 <sup>b</sup>	10.82 <sup>a</sup>
Starter	15.28 <sup>c</sup>	15.56 <sup>c</sup>	16.40 <sup>b</sup>	17.06 <sup>a</sup>
Combined	47.72 <sup>d</sup>	49.29 <sup>c</sup>	51.17 <sup>b</sup>	51.4 <sup>a</sup>
----- ME Intake, Mcal/lb -----				
Milk Replacer	231.00 <sup>b</sup>	229.94 <sup>bc</sup>	227.71 <sup>c</sup>	233.91 <sup>a</sup>
Starter	243.32 <sup>c</sup>	247.66 <sup>c</sup>	261.51 <sup>b</sup>	271.89 <sup>a</sup>
Combined	528.09 <sup>c</sup>	533.18 <sup>c</sup>	543.85 <sup>b</sup>	551.15 <sup>a</sup>

## Summary

- Increasing intake of Protein and ME during the first 8 weeks of life increased ADG
- Although Protein and ME of Milk Replacer was a significant contributor to ADG in these studies, Starter Protein and ME had the largest effect due to ad lib feeding
- Consuming higher amounts of both Protein and ME during the first 8 weeks of life positively affected first lactation 305 day milk

## Summary, continued

- Variation was high in predicting first lactation milk production from Protein and ME intake in early life, indicating additional factors affect first lactation milk production
- One factor shown in these studies was season of birth with calves born in the fall and winter have greater combined Protein and ME intake

## Thank you

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