Effects of Megalac®-R on Reproduction in Holstein Cows

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Outline

- Background
- Trial design
- Materials and methods
- Results
- Discussion
- Questions

What do EFAs Do?

Aid in production of **steroid hormones**

EFAs
Linoleic and linolenic acids

Eicosanoids (biological signaling factors, including prostaglandins)

Fluidity and elasticity of all cell membranes

Synopsis of Staples et al. (1998)

- Found 11 studies reported an improvement either in first A.I. service conception rate or in the overall rate of conception or pregnancy
  - ($P<0.10$ or $\geq$15% difference between means)
- A greater proportion of cows fed calcium salts of long chain fatty acids (Ca-LCFA) showed stronger signs of estrus, had more active ovaries, and required less exogenous $PGF_{2\alpha}$ to induce estrus

-J. Dairy Sci. 81: 856-871

Positive Feedback from Ca-LCFA

Result	Control	Ca-LCFA
Stronger signs of estrus (exhibited standing estrus)	65.6%	71.4%
Active ovaries (palpation per rectum)	69.5%	75.4%
Less exogenous $PGF_{2\alpha}$ to induce estrus	43.7%	55.7%

Results of 5 studies summarized by Staples et al. (1998)

What is Megalac®?

- High energy feed supplement containing Ca LCFA
- Net energy of lactation value of 6.5 Mcal/kg.
- Calcium salts are ruminally inert and do not interfere with rumen fermentation

What is Megalac®-R?

- Nutritional supplement containing Ca CFAs
- Maintains the energetic and rumen inert properties of regular Megalac®
- Devised to transport EFAs (linoleic and linolenic acids) to the small intestine for absorption

Comparison of Megalac® and Megalac®-R

	Megalac®	Megalac®-R
Linoleic acid	7.00%	31.75%
Linolenic acid	0.20%	4.70%

-Adapted from Arm & Hammer's Megalac®-R Research Summary (2002)

EFA Amounts in Various Diets

Parameter	Basal	Megalac	Megalac-R	EB	T	RS	WCS
Fatty Acids*							
Intake (g/d)	500	400	400	400	400	400	400
Rumen Escape (%)	15	54	54	0	2	16	1
Duodenum (g/d)	659	400	400	400	400	404	404
Absorbed (g/d)	479	327	337	291	293	298	300
Intest. Digestion (%)	73	82	84	73	73	74	74
C18:1trans*							
Intake (g/d)	0.1	0.0	0.0	1.6	5.2	0.0	0.0
Duodenum (g/d)	37.0	2.3	11.0	1.9	5.6	39.7	30.3
Absorbed (g/d)	29.0	1.8	9.1	1.5	4.4	31.2	23.8
C18:2*							
Intake (g/d)	225	28	127	7.2	18.8	230	157
Duodenum (g/d)	58	17	77	0.7	2.2	54	12
Absorbed (g/d)	48	17	76	0.6	1.8	43	10
C18:3*							
Intake (g/d)	23.9	0.80	18.81	0.0	33.9	13.2	1.60
Duodenum (g/d)	1.6	0.46	10.88	0.0	1.0	2.5	0.09
Absorbed (g/d)	1.1	0.40	9.32	0.0	0.8	1.9	0.06

* From basal diet or supplement

-Adapted from Arm & Hammer's Megalac® -R Research Summary (2002)

Effects of improved bypass fat on 21-d pregnancy rates

Prepartum	Postpartum	No. of cows	Avg. 21-d pregnancy rate (%)
Study A			
Control	Megalac	549	18.6
Megalac-R	Megalac	528	23.9
Study B			
Megalac	Megalac	552	35.5
Megalac-R	Megalac-R	591	42.3
Study C			
Megalac-R	Megalac	742	20.0
Megalac-R	Megalac-R	866	23.0

-Adapted from Stevenson (April 10, 2006) Hoard's Dairyman

UA Reproductive Trial

- **Part 1:** Real-time ultrasonography to evaluate ovarian structures
- **Part 2:** P_4 analysis of milk samples for cyclic profiles
- **Part 3:** Tracking of uterine health through veterinarian's prescription of prostaglandins
- **Part 4:** Ovsynch regimen to evaluate conception rates between treatments

2004 Benchmark Data for UA Reproductive Trial from DHI-Plus

- **Goldman Dairy**, Coolidge, AZ
- Number of cows = 2,003 cows
- Milk = 9896 kg/cow/lactation
- Milk = 34.5 kg/d
- First service = 75 DIM
- Services per conception = 2.6
- Days open = 152

Materials and Methods

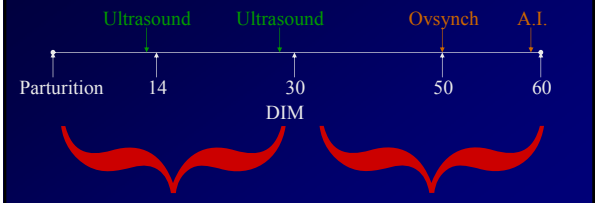
- Holstein cows not receiving bST
- Treatments assigned randomly
- Balanced by parity and milk yield in their previous lactation
- Heifers balanced by sire PTAs

Ration

- 3 wks prepartum
  - All cows fed 0.159 kg/d Megalac®
- Parturition-150 DIM
  - Cows either fed 0.159 kg/d of Megalac® or Megalac® R
  - Rations balanced to equalize caloric intakes

Trial Timeline
(April 2005- January 2006)

Cows fed Megalac 21d prepartum, Megalac or Megalac-R postpartum until 150DIM



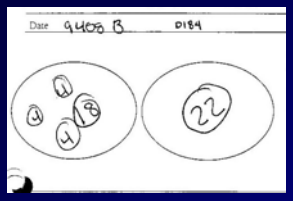
Milk samples collected twice weekly until ~100DIM

Uterine health data collected until ~90DIM

Part 1: Ultrasound

- Conducted by Dean Fish
- 136 cows total
- Conducted at 2 and 4 wks fresh
- All ovarian structures were recorded

Ultrasound Data



- Follicles were divided into classes
  - 1: 1-5 mm
  - 2: 6-10 mm
  - 3: 11-15 mm
  - 4: ≥ 16 mm
- Corpora hemorrhagica were recorded as CL
- Notes were made if cow had metritis, fever, foot rot, etc.

Ultrasound Results- Follicle Diameters

		Megalac®		Megalac® R	
Class	DIM	1-14 9 cows	15-30 60 cows	1-14 20 cows	15-30 47 cows
1 **(1-5 mm)**		25	102	58	112
2 **(6-10 mm)**		11	57	22	60
3 **(11-15 mm)**		5	30	12	22
4 **(>16 mm)**		3	29	4	19
Mean size (mm)		8.56	8.53	6.37	7.62

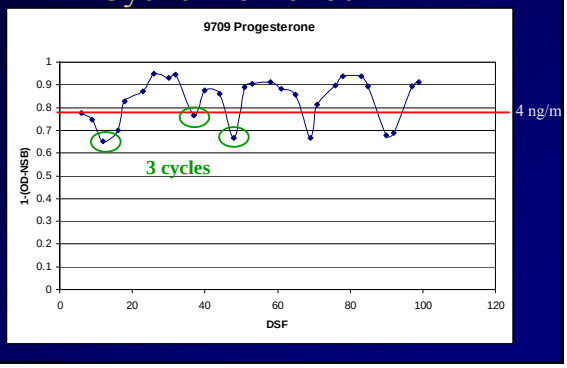
Ultrasound Results- Presence of CLs

Trait	Megalac®	Megalac® R	Chi- square
Ovulations by 30 DIM	18/69	31/67	
% ovulations	26	46	10.60 **(*P*≤ 0.01)**

Part 2: Progesterone Analysis

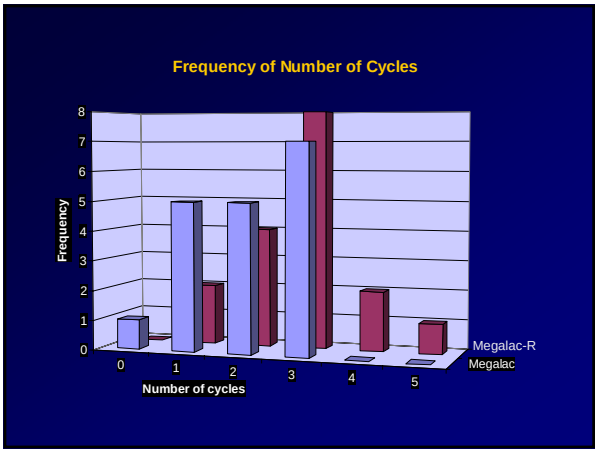
- Milk samples were collected on cows until 100 DIM
- Stored at- 20ºC
- Analyzed using kit from Assay Designs (Ann Arbor, MI)

Cyclic Profile- 60 DIM

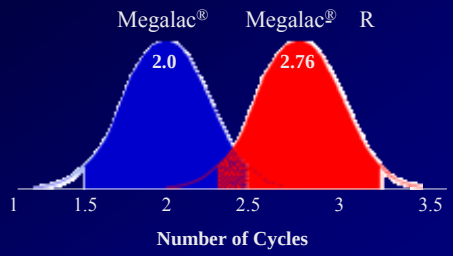


Cyclic Profile Results

	Megalac® n=18	Megalac® R n=17	*P*-value
Overall [P] (ng/ml) 1st 60 DIM	5.90	5.0	≤ 0.192
Number cycles 1st 60 DIM	2.0	2.76	**≤ 0.031**
Range in number cycles	0 – 3	1- 5	
95 % C.I. for number cycles	1.52 - 2.48	2.27 - 3.26	



Frequency Distribution of Cycles 60 DIM



Part 3: Uterine health

- Dr. Tony Martin, herd veterinarian
- Prescribed Lutalyse (prostaglandin) as a uterine therapy
  - Metritis
  - Uterine tone
  - Clean-out
  - Cystic ovaries

Metritis

- Uterine infection, generally bacterial
- Incidence ranges from 3-36% between herds across the U.S.
- Estimated loss to producer is $106/case
  - Includes milk loss, reproductive loss, treatment cost, culling loss

(Fuhrmann, 2006)

Uterine Health Data

- Event Analysis reports were generated using DHI-Plus software
- Recorded any prostaglandin (LUT) injection
- Cystic ovaries were treated with GnRH, followed by LUT in 10 days

Uterine Health Results

Trait	Megalac®	Megalac®	RChi-square
Metritis by 60 DIM	511/1312	205/708	
% metritis	**38.9**	**29.0**	17.8 **(P≤ 0.001)**
Cysts by 90 DIM	12/1312	18/708	
% cysts	0.9	2.5	

Part 4: Ovsynch

- VWP= 50 DIM
- Ovsynch was initiated on d50 56
  - D 0: GnRH
  - D 7: Prostaglandin
  - D 9: GnRH
  - D 10: Timed A.I.

Ovsynch Results

Trait	Megalac® n=130	Megalac® n=111	R
1st service conception	29.2% (38)	24.3% (27)	
2nd service conception	46.7% (43)	39.2% (33)	
Number cows confirmed pregnant by 200 DIM	84% (111)	88% (98)	
Services/conception	2.00	2.00	
Days open	101	103	

Results

Trait	Megalac®	Megalac®-R	*P* value
3.5%FCM (kg/d)	36.9	37.1	NS
Ovulations(%) by 30DIM	17/63 **(27%)**	28/57 **(49%)**	≤ 0.01
Number of cycles by 60DIM	**2.00**	**2.76**	≤ 0.03
Metritis (%) by 60DIM	511/1312 **(38.9%)**	205/708 **(29.0%)**	≤ 0.01
Cysts (%) by 90DIM	12/1312 **(0.9%)**	18/708 **(2.5%)**	

Conclusion

Megalac®-R-fed cows had…

- more ovulations early postpartum
- more estrous cycles by VWP
- fewer uterine health issues

…than cows fed Megalac®.

Conclusion

- Feed fat not only for its energy, but because **it affects the overall reproductive health and efficiency of the cow!**