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ANIMAL NUTRITION & HEALTH

Managing the Transition Cow-Emphasis on Ketosis and Fatty Liver Syndrome

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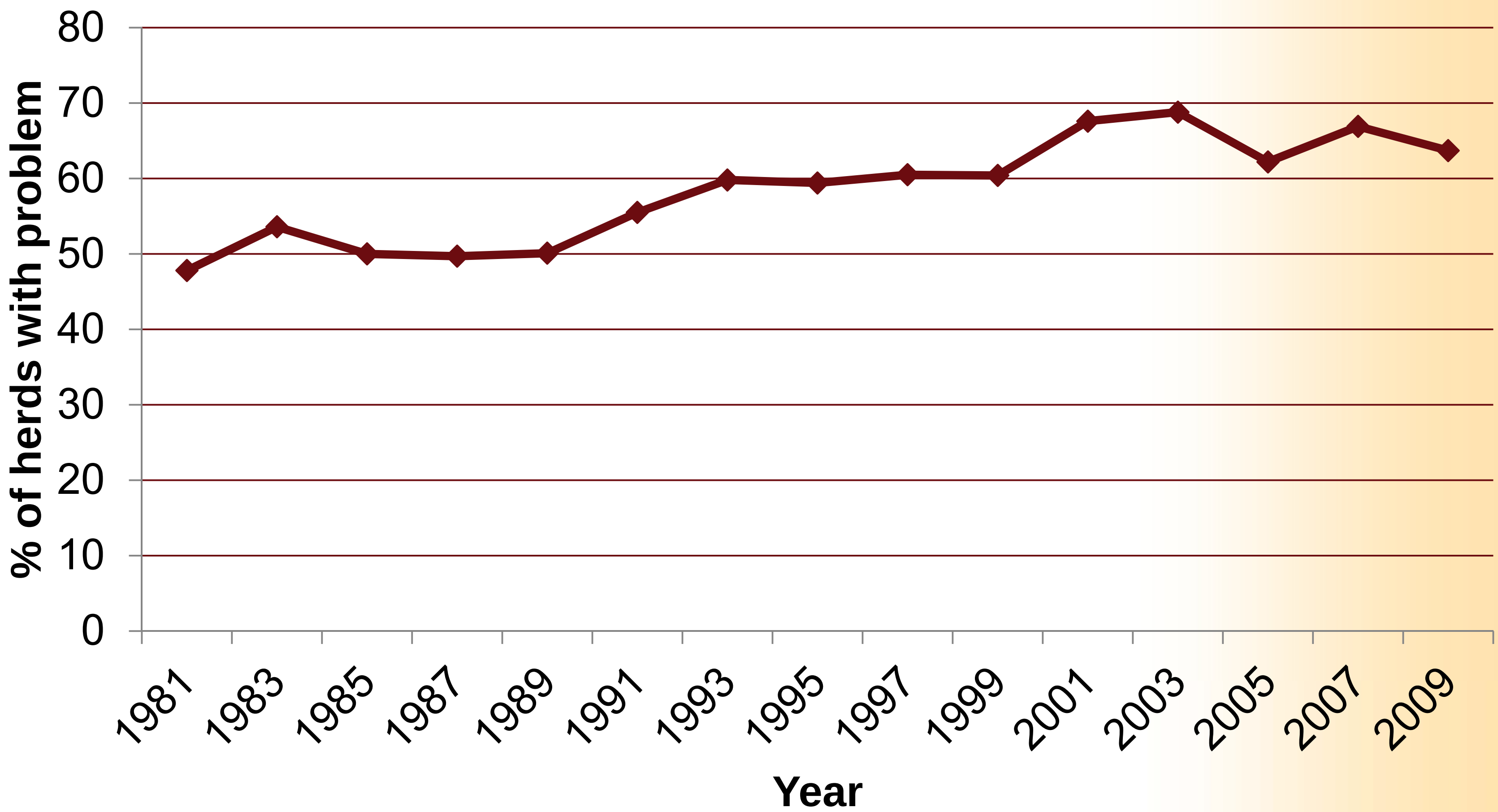
Topics

- Introduction
- Etiology of Fatty Liver and Ketosis
- Strategies for Prevention
- Management of Fatty Liver and Ketosis Through Basal Diet
- Management of Fatty Liver and Ketosis through Feed Additives

Are Things Getting Any Better?

Clinical Mastitis	**USDA NAHMS**	
	1996	2007
	13.4 %	16.5%
1st Service Conc. Rate	**Butler, 2005**	
	1975	2001
	55%	39%
Ketosis	"Since the late 1990's ketosis has emerged as the most important metabolic disease in dairy herds in the US, surpassing ruminal acidosis and milk fever in clinical significance" ***Oetzel, 2007***	

Hoard's Dairyman Survey- Ketosis



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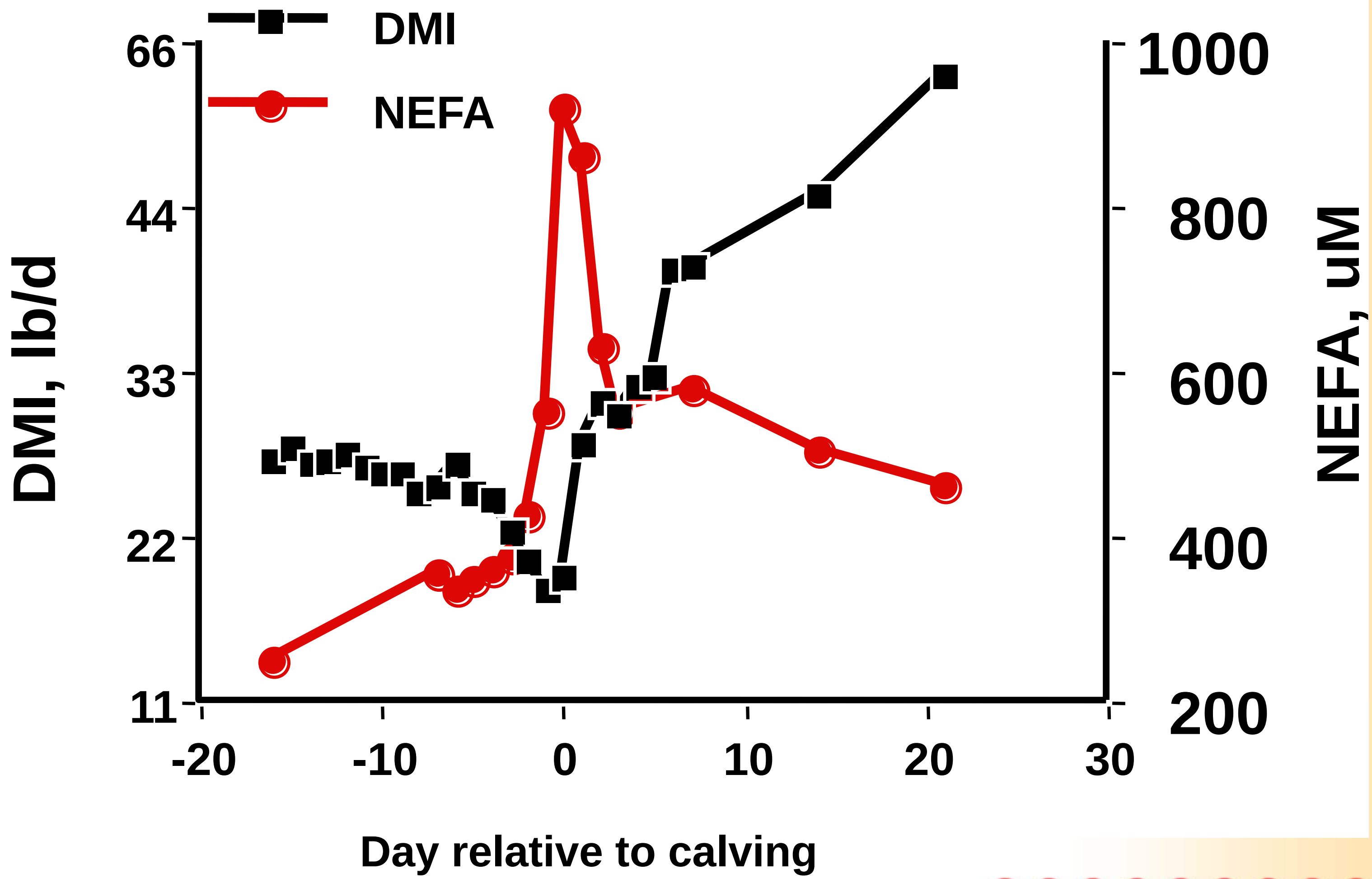
The Record Cow

	365 d	Ave/d
Milk, lb	72,169	185.9
Prot, lb	2786	7.5
Fat, lb	2141	5.95
Calf req, lb milk/d for 42 d		10

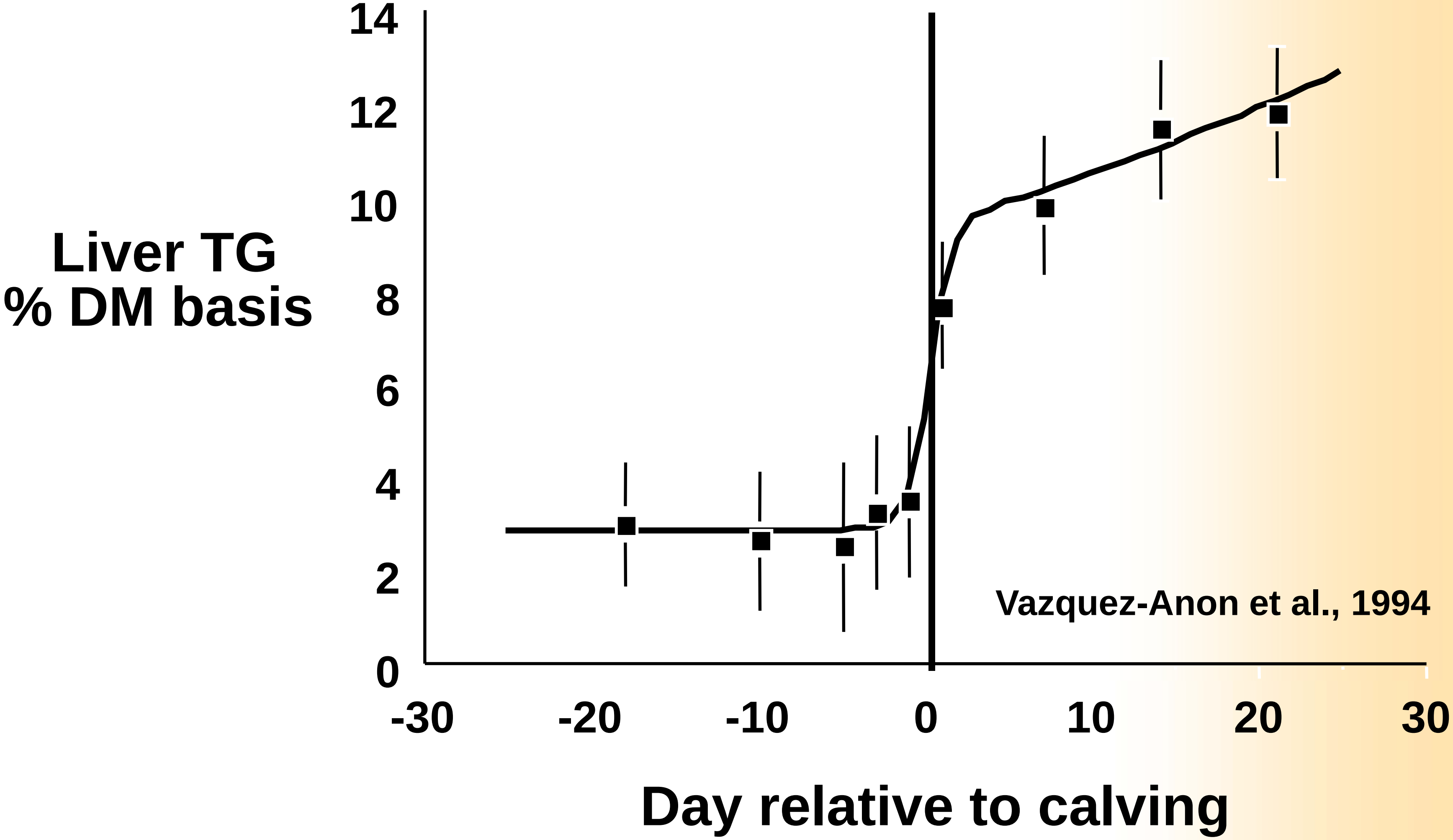
Ever-Green-View My 1326 ET
Waldo, WI
3x/365 days

Dry Matter Intake and Plasma NEFA

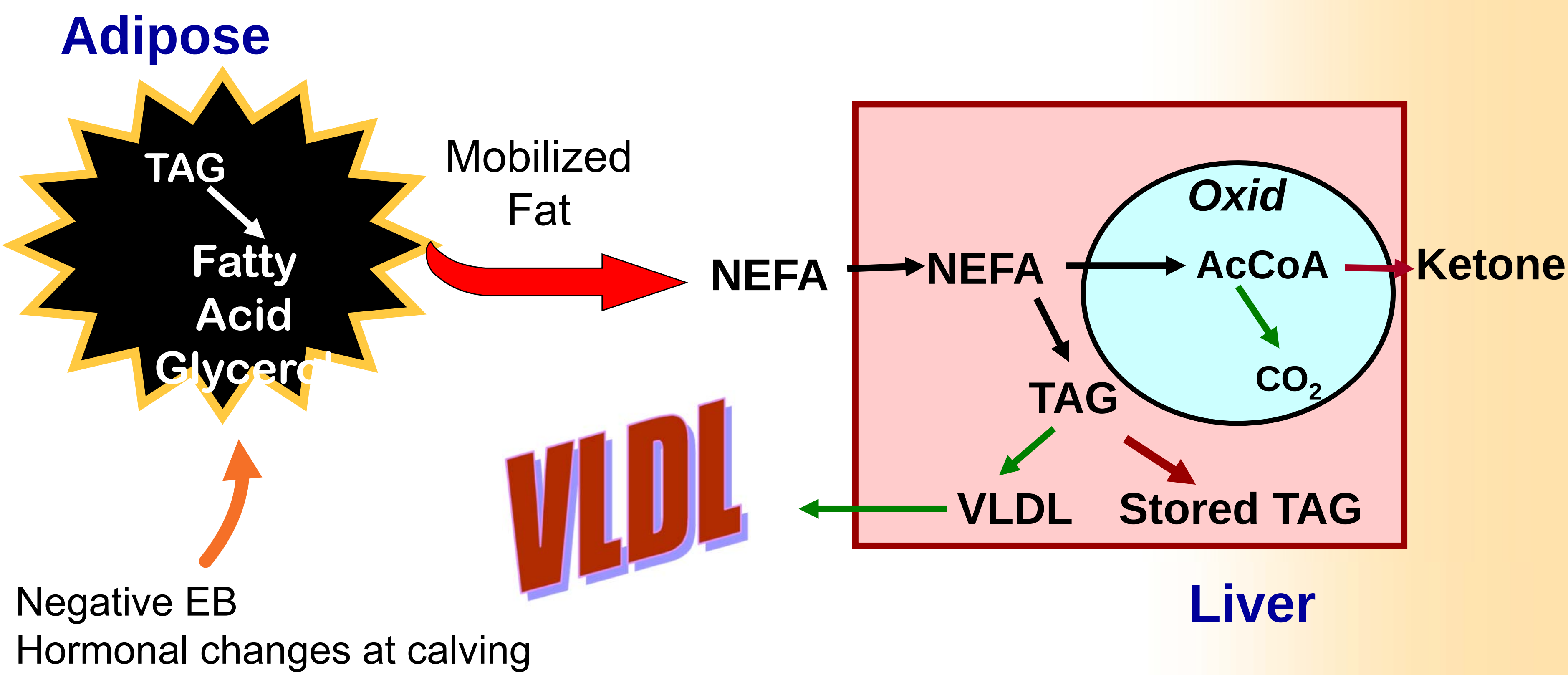


Grummer, 1993

Liver Triglyceride



Transition Cow Lipid Metabolism



Can We Manage Energy Related Disorders-- Fatty Liver and Ketosis-- via Dry Cow Diets?

Pre-fresh NFC??

Trial	NFC, % DM
Minor et al., 1998	35
	44
Mashek and Beede, 2000	35
	38
Keady et al., 2001	13
	28
Holcomb et al., 2001	25
	30
Doepel et al., 2001	24
	30
Rabelo et al., 2003, 05	38
	45
Smith et al., 2005	34
	40
Kamiya et al., 2006	28
	33

Summary of Results

- 5/7 Studies showed a significant increase in prepartum DMI.
- 0/6 Studies showed any significant effect on postpartum DMI.
- 0/7 Studies showed any significant effect on milk yield.
- 1/5 Studies showed a significant reduction in liver fat.

Pre-fresh NFC??

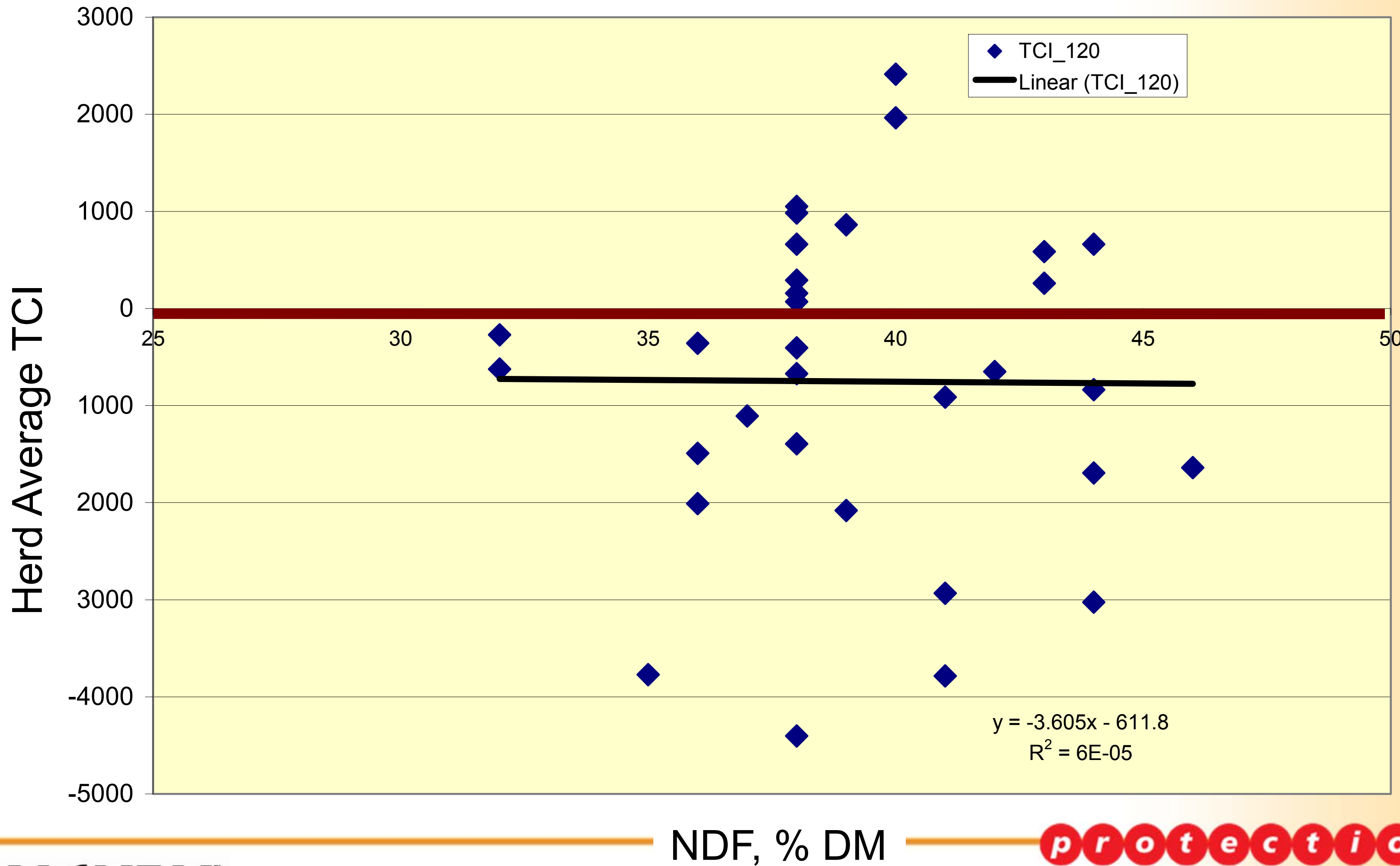
- If increasing prepartum concentrate (NFC) feeding does not affect milk yield or DMI, energy balance will not be affected
- If energy balance is not affected, metabolic health and reproductive performance will probably not be affected.

Transition Cow Index (Nordlund and Co-workers)

- The Transition Cow Index uses fourteen factors from the historical DHIA record of each individual cow to project her milk yield

- Deviations from her expected milk yield are calculated and used at the herd level to evaluate the overall effectiveness of transition cow management programs.

Prefresh ration NDF %



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Courtesy of Ken Nordlund

Other 3 wk Pre-fresh Studies

- Substituting non-forage NDF for forage NDF (3 studies)
  - Milk: 0/3
  - Feed intake: 0/3
  - NEFA or fatty liver: 0/2
  - BHBA: 1/2 (decreased 1.2 mg.dL)
- Ad libitum vs restricted energy (3 studies)
  - Milk: 0/3
  - Feed intake: 0/3
  - NEFA: 0/3
  - BHBA or fatty liver: 0/1

What about the entire dry period?

High forage diets?

Energy limitation?

Energy Limitation the Entire Dry Period (Overfed vs ~80-100% of Maintenance)

Study	Grum 1996	Agenas/Ho Itenius 2003	Douglas 2006	Winkelman 2008	Neilsen 2009	Keogh 2009	Janovic k 2010
Duration	56 d	64 d	60 d	45 d	100 d	70 d	65d
Method	F:C	FR	FR	FR	F:C&F R	FR	F:C or FR
DMI, lb/d	NS	NS	+4.6	NS	NS	Fixed	NS
Milk or ECM, lb/d	NS	NS	NS	NS	NS	-4.8	NS (-20.5)
NEFA, mEq/L	NS	-.15	-.10		-.14	-.11	↓
BHBA, mg/dl	NS	NS	-1.2		-0.7	+0.9	↓
Liver TG, % wet wt	NS		-2.6		NS		↓

Cut off for significance, $P < .10$

Energy Limitation the Entire Dry Period

(Overfed vs ~80-100% of Maintenance;
6 studies from 1996 to 2010)

- ↑Feed intake: 1/6 (4.6 lb increase)
- ↑Milk (or ECM): 0/7
- ↓NEFA: 5/6 (.10-.15 mEq/L decrease)
- ↓BHBA: 3/6 (.7-1.2 mg/dL decrease)
- Liver TG: 2/4 (-2.6% unit decrease)

Conclusions: Dry Cow Feeding

- Lots of flexibility in what we feed during the final 3 wks before calving.
- Overfeeding feeding during the entire dry period may have modest negative effects on plasma NEFA, BHBA and liver TG; however, lactation performance does not seem to be affected.
- Dry cow feeding may offer limited potential to alter postpartum health and production

Management of Fatty Liver and Ketosis via Feed Additives?

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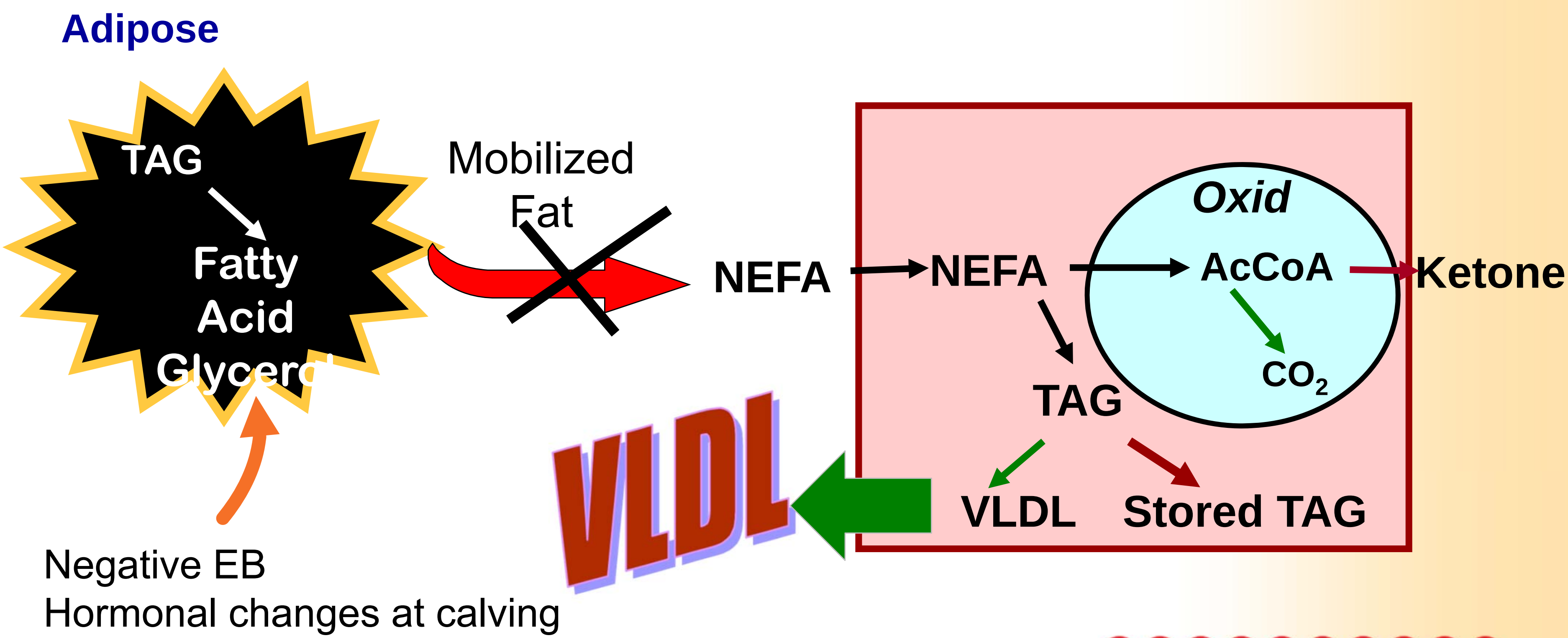
Additives to Prevent Fatty Liver/Ketosis

1. Block mobilization of fat from adipose tissue
2. Increase fat (VLDL) transport out of the liver



Choline

- Referred to as a vitamin, but it is not
  - Can be synthesized endogenously
  - Not an enzyme cofactor
  - Supplemented in large quantities
- Proven as essential nutrient for many species
- Classic deficiency symptom: fatty liver

Functions of Choline

- One carbon (methyl) metabolism
  - Spare methionine
- Constituent of phospholipid
  - Phosphatidlycholine
    - Membrane
    - Lipoproteins (blood lipid transport)
- Acetylcholine (neurotransmitter)

Choline

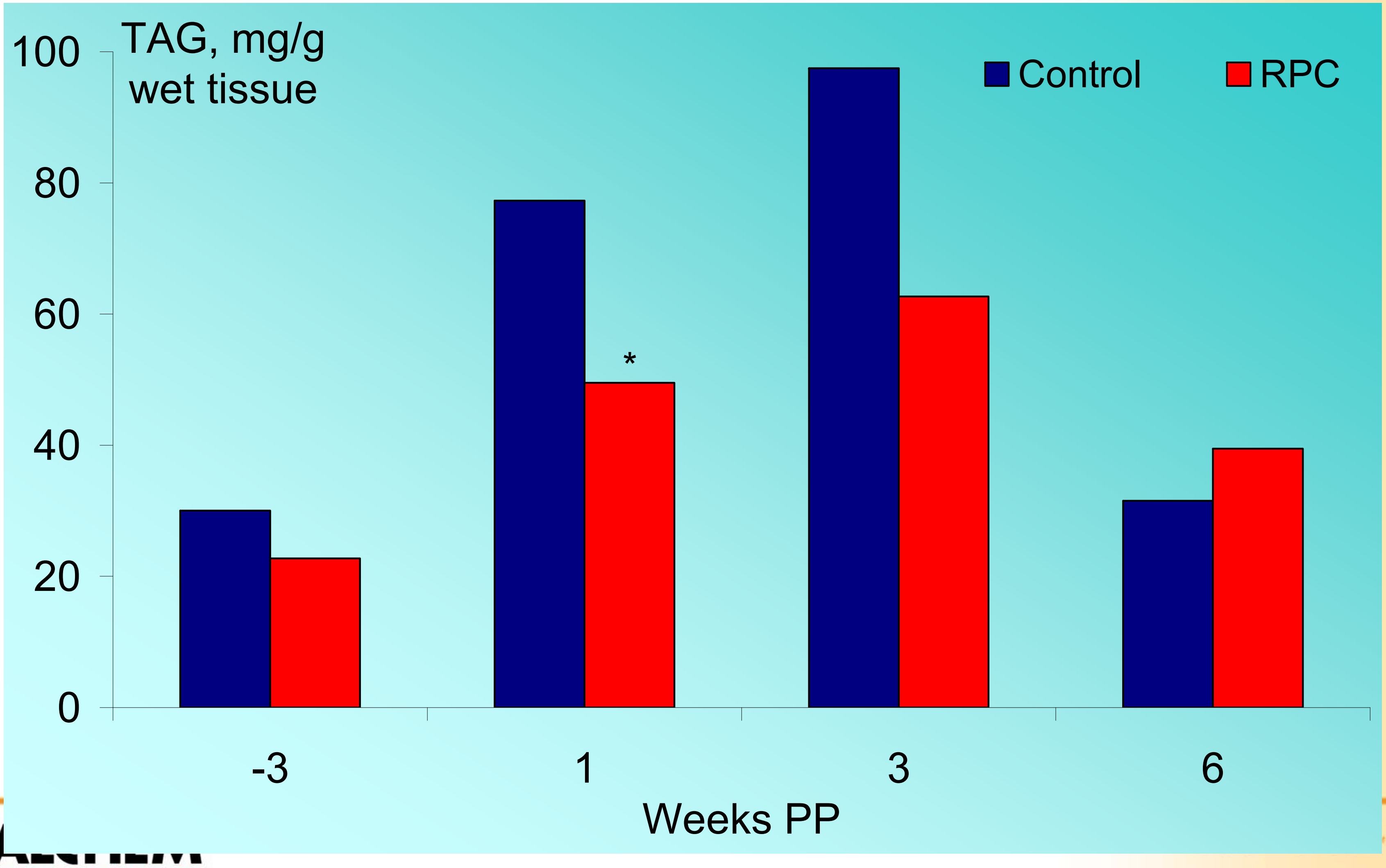
Dr. R. Erdman (1992)

- Is choline a limiting nutrient for ruminant animals?
- Feed intake: 30 g/d
- Escaping ruminal breakdown: 1g/d
- Ruminal production: 0 g/d
- Supply to intestine: 1 g/d
- Excreted in milk: 5 g/d
- Potential requirement: 30 to 50 g/d

Is there a role for supplemental choline in prevention of fatty liver??

- Cornell research showed that RPC reduced liver TG in transition cows, but NS (P < .18)
- UW research showed that RPC prevented and alleviated fatty liver in feed restricted dry cows

RPC: Reduced TAG at wk 1 (P = .04) and 3 (P = .12)



Zom et al., 2010

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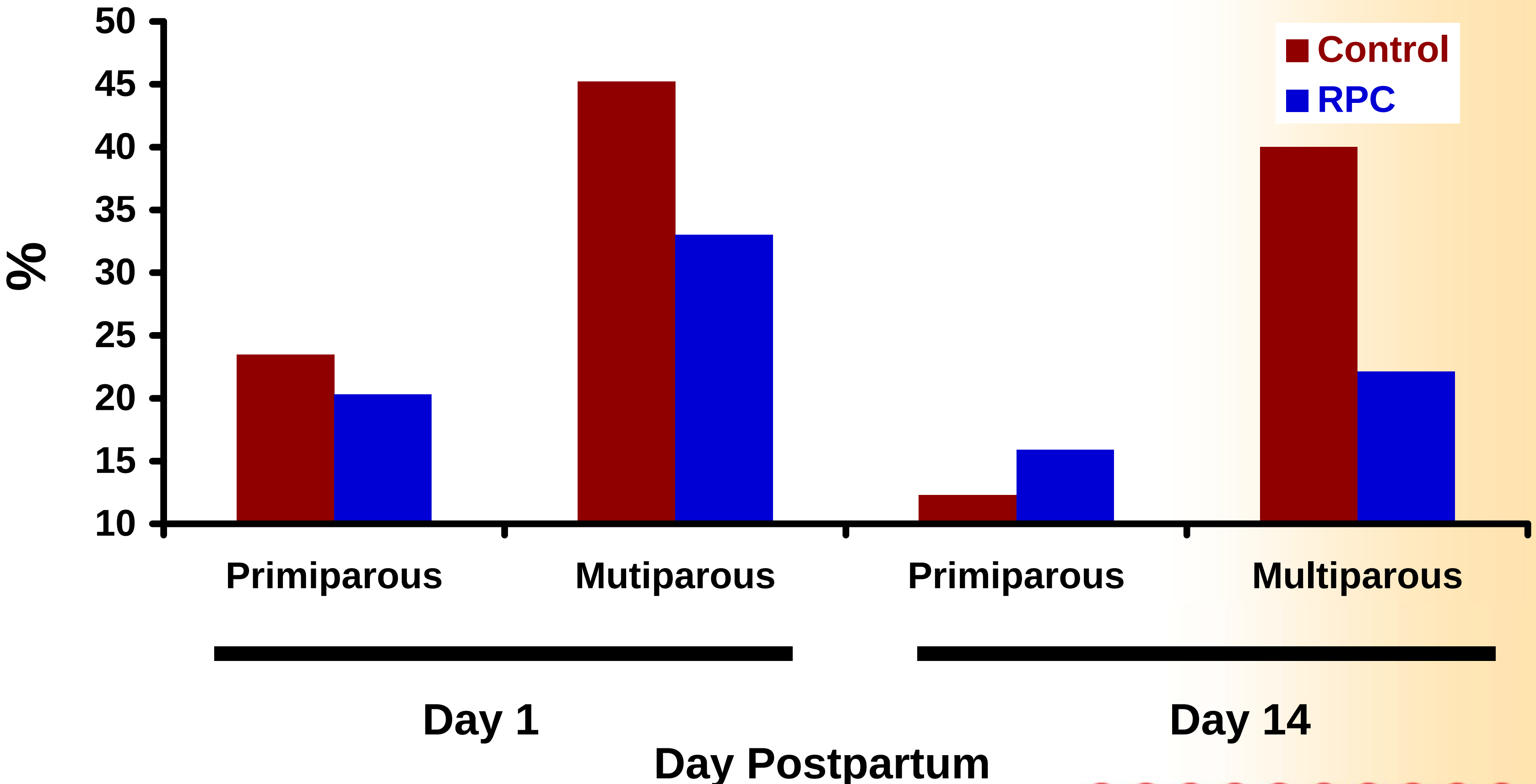
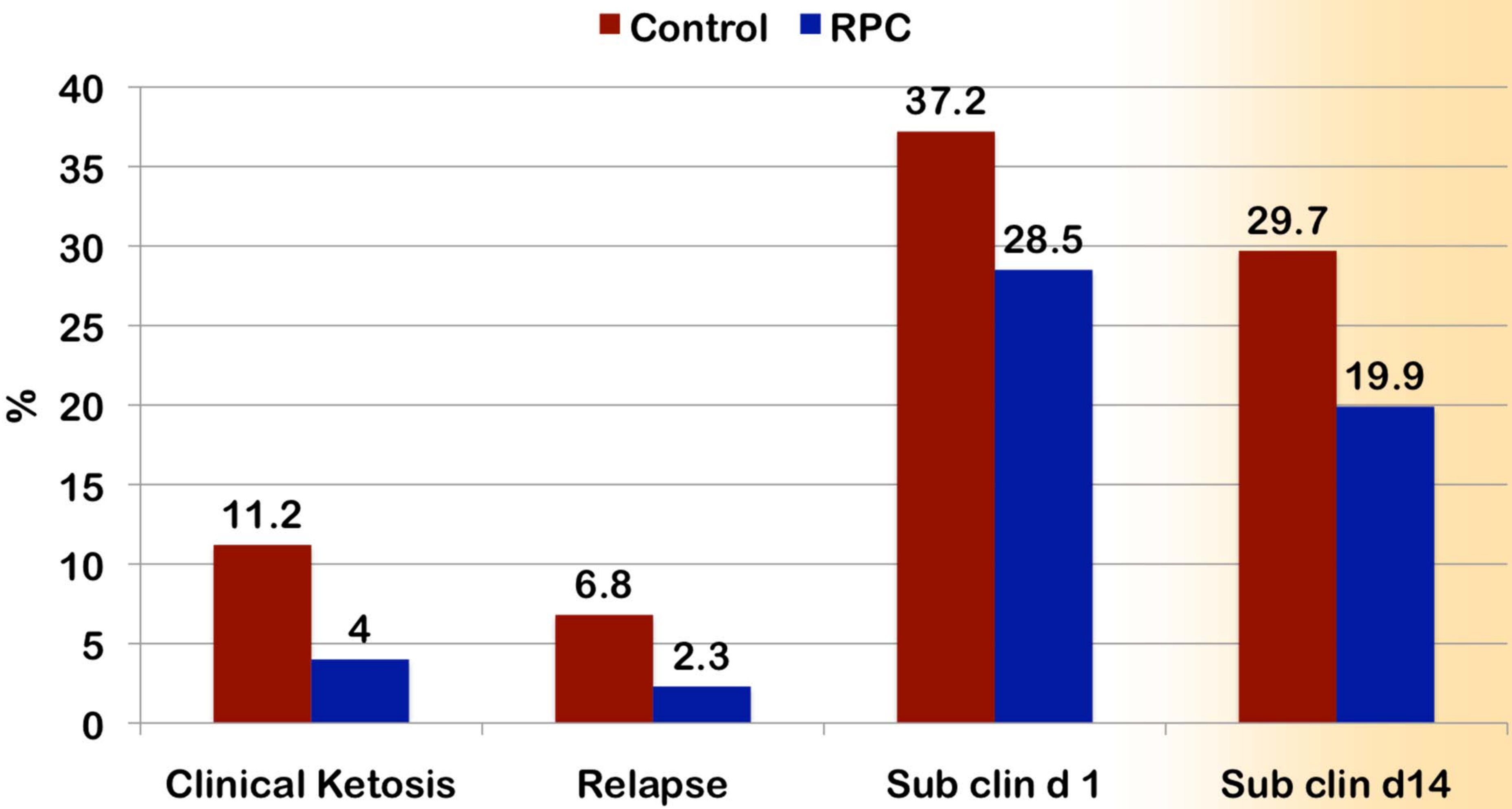
Effect of RPC (-3 wk to 80 DIM) on Subclinical Ketosis

Lima et al., 2007

Treatment: *P* = 0.07 TRT*Parity*:* *P* = 0.05



Effect of RPC on Ketosis- All Cows



P = .01 .05 .07 .35

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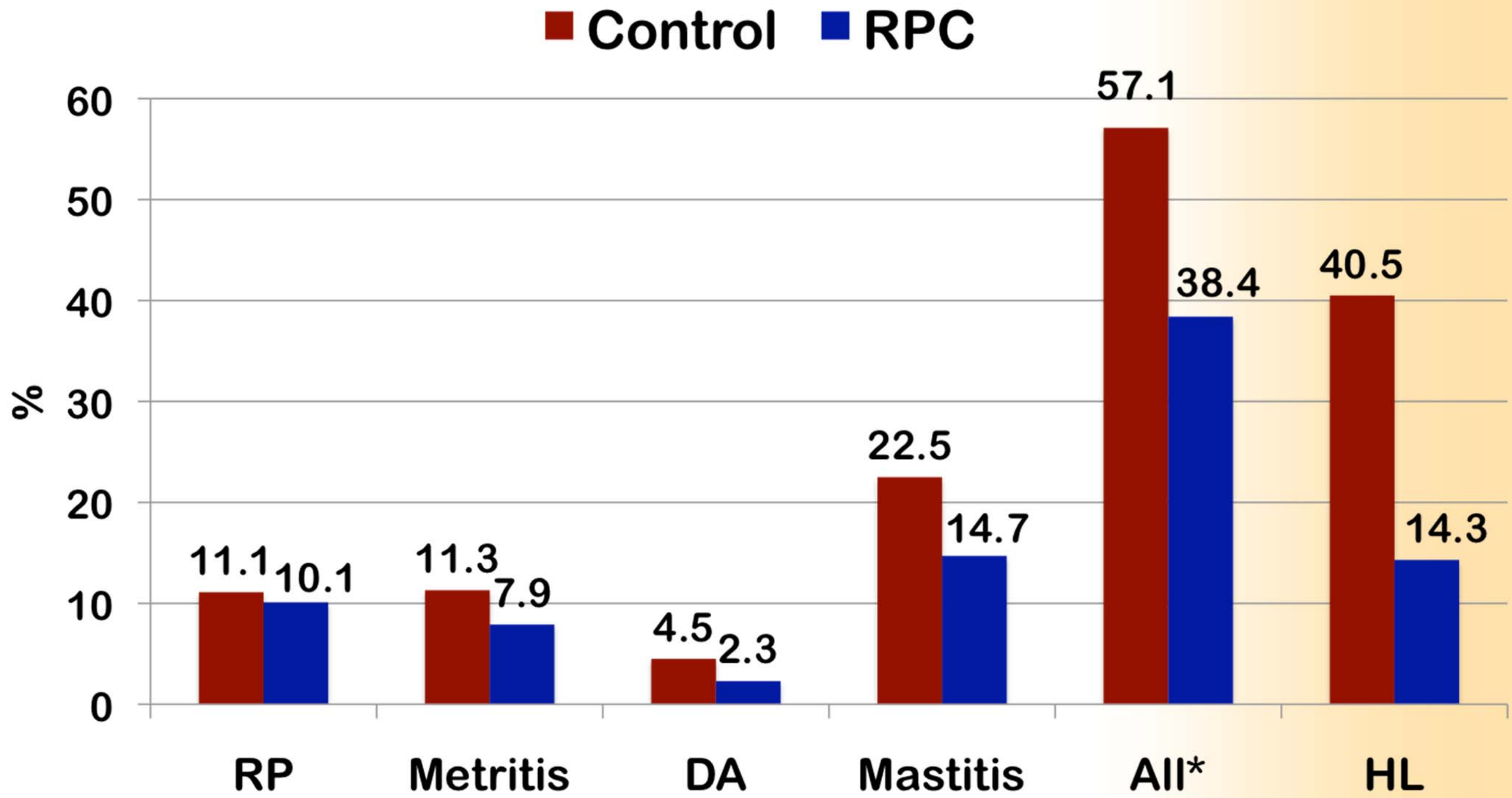
Effect of RPC on Health- All Cows



P = .72 .33 .77 .06 .001 .05

* Includes clinical ketosis

A Summary of Studies in Which Protected Choline was Fed to Transition Cows

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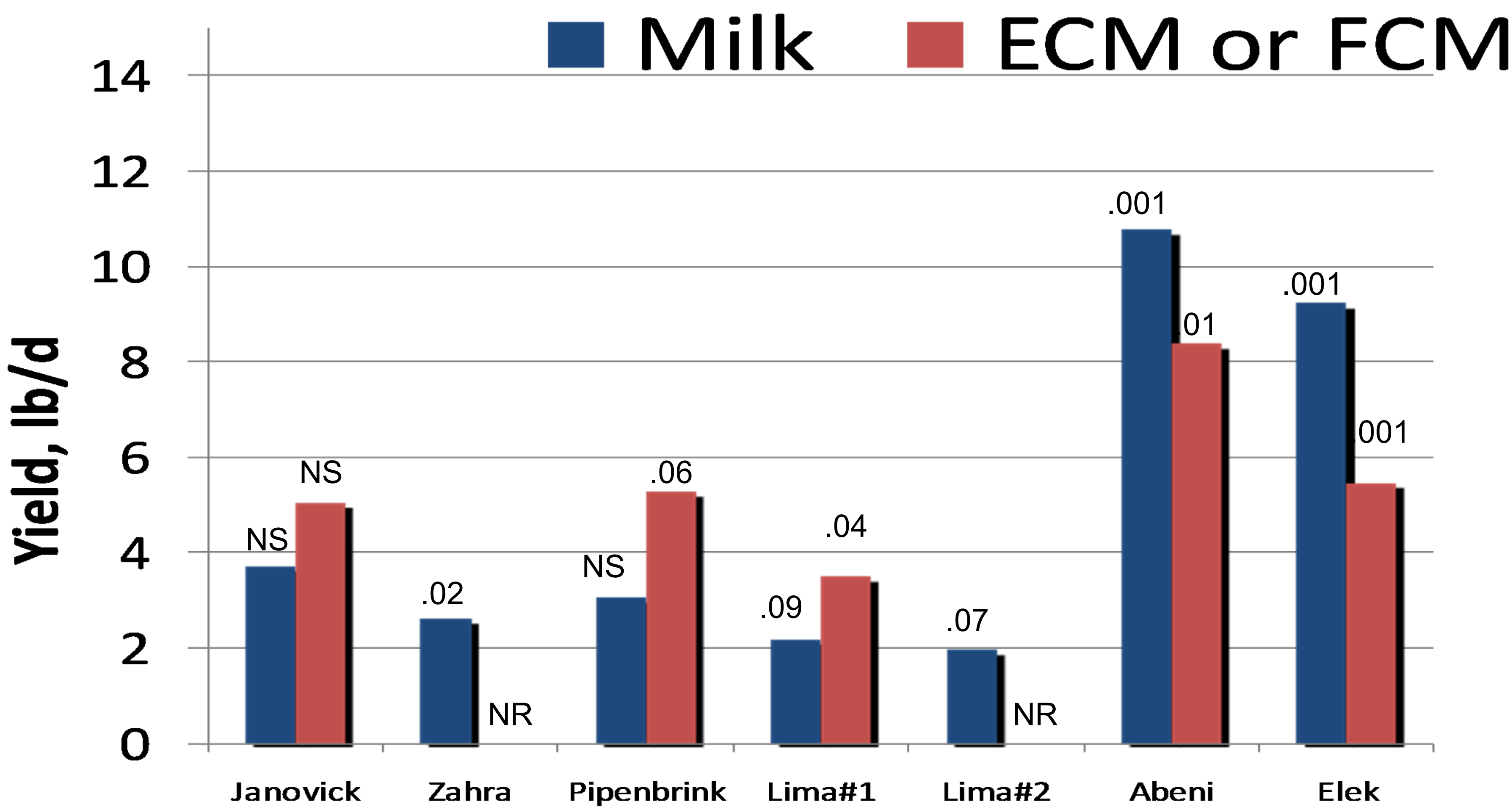

d fed:	**-21-+21**	**1-+28**	**-21-+63**	**-25-+80**	**-22-0**	**-21-+35**	**-21-+60**
d measured:	**1-49**	**1-28**	**1-63**	**1-90**	**1-80**	**1-70**	**1-60**

Summary- Choline

- Supplemental protected choline prevents and alleviates fatty liver and reduces the incidence of ketosis
- Overall animal health is improved
- Supplementation of choline to transition cows increases milk and FCM production

Summary

- Altering pre-fresh diets seems to have little effect on postpartum performance.
- Restricting energy for the entire dry period may have modest positive effects on metabolic parameters; limited effects on postpartum production.
- Feed additives represent a means to reduce post-fresh lipid related metabolic orders and improve production; those that enhance lipid export from the liver are preferred.

Thanks!
Questions?