Feeding for high milk components

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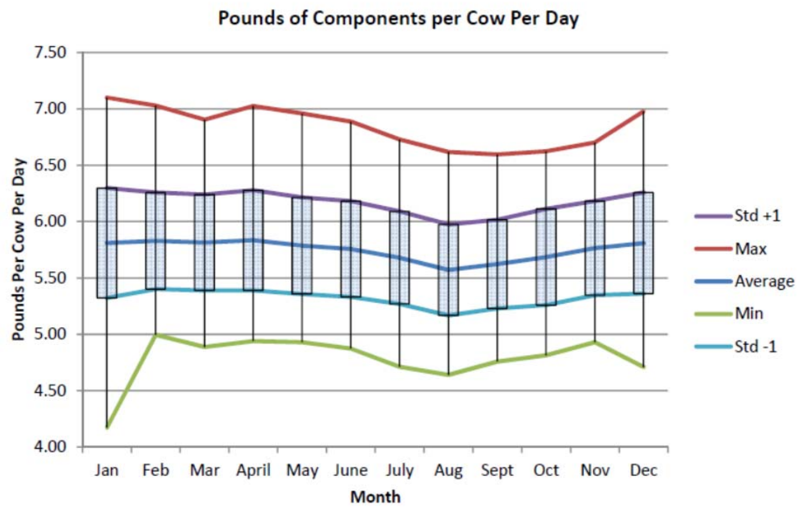
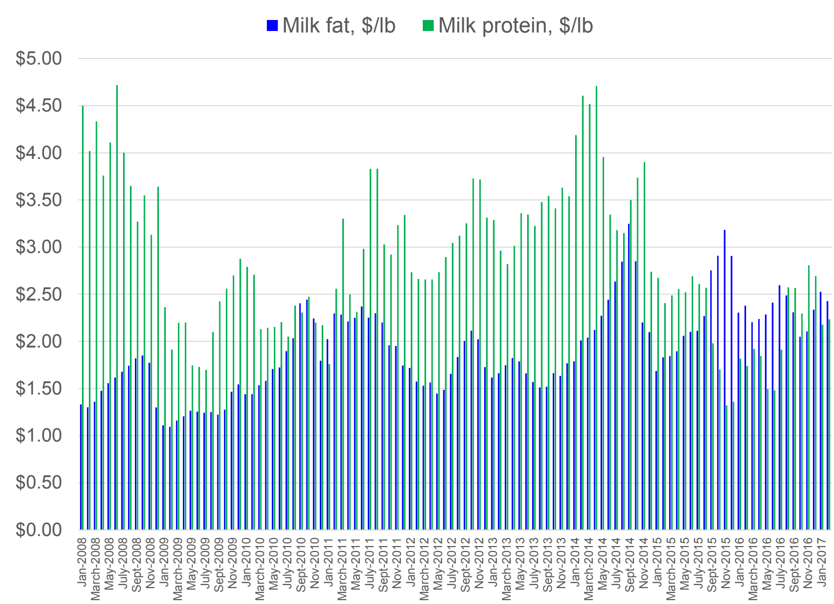
4 herds with IOFC > $12.99 per cow per day					
	1	2	3	4	**Average**
High ECM	95.5	95.3	99.5	91.6	**95.48**
High Fat and Protein lbs per cow per day	6.29	6.37	6.68	6.06	**6.35**
Higher Feed Efficiency (ECM/DMI)	1.75	1.69	1.75	1.68	**1.72**
Higher cost/cow per day	7.81	7.24	8.2	7.16	**7.60**
Lower stocking density, % of stalls	101	108	79	105	**98**
Higher Forage NDF intake, % of BW	0.91	0.96	1.04	0.95	**0.97**
Similar milk fat %	3.59	3.96	3.94	3.70	**3.80**
Similar milk protein %	2.91	3.05	3.09	2.99	**3.01**
Slightly higher cost per lb DM	0.143	0.128	0.144	0.131	**0.137**

3 herds with IOFC < $11.00 per cow per day				
	1	2	3	**Average**
Lower ECM	77.8	80.5	76	**78.10**
Lower Fat and Protein lbs per cow per day	5.18	5.43	5.09	**5.23**
Lower Feed Efficiency (ECM/DMI)	1.57	1.6	1.6	**1.59**
Lower cost/cow per day	6.49	6.8	6.2	**6.50**
Higher stocking density, % of stalls	132	115	94	**114**
Lower Forage NDF intake, % of BW	0.87	0.81	0.6	**0.76**
Similar milk fat %	4.08	3.84	3.76	**3.89**
Similar milk protein %	2.94	3.14	3.11	**3.06**
Slightly lower cost per lb DM	0.131	0.135	0.13	**0.132**

Dairy Profit Monitor -- www.dairyprofit.cornell.edu
Same 76 farms – January – December 2016





USDA-NASS data accessed 3/26/17 at: http://future.aae.wisc.edu/index.html

How do we maximize milk fat?

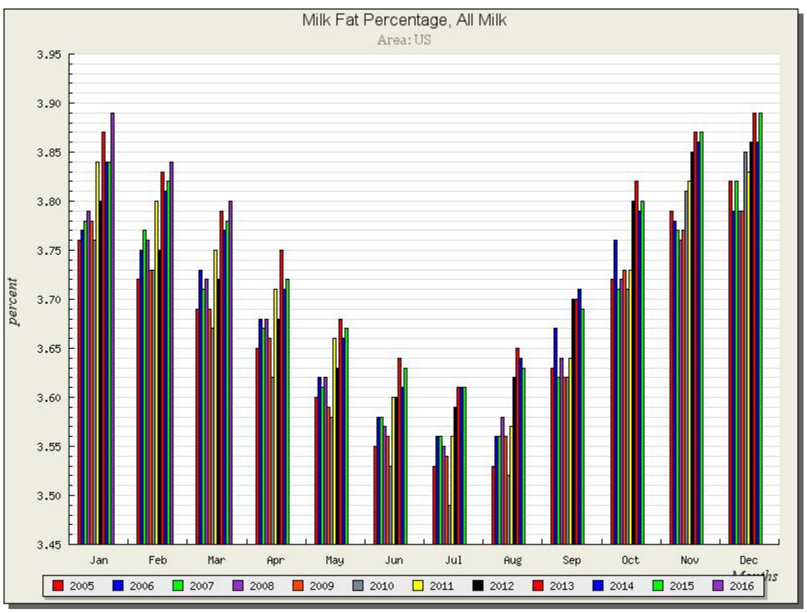
Sources of milk fat

- “De novo” – made by the mammary cells
  - Short- and medium-chain fatty acids
- “Pre-formed” – extracted from the blood by the mammary gland
  - Long-chain fatty acids from diet and body fat (esp. in early lactation)
- “Mixed” – both made in the mammary gland and extracted from the blood

- ~ 50% of milk fatty acids made in mammary gland and about 50% extracted from the blood

Many non-nutritional factors affect milk fat

- Genetics/breed
- Days in milk
- Season
- Heat stress
- Feeding patterns/stocking density
- Sampling strategy/analytical methods



Source: http://future.aae.wisc.edu/data/monthly_values/by_area/450?area=US&tab=production&yoy=true

Possible explanations for seasonality in milk fat percentage

- Changes in silage quality/characteristics?
- Photoperiod?
  - Prepartum day length negatively correlated with milk yield and milk fat and protein percentage (Aharoni et al., 2000)
- Changes in feeding behavior?
- Heat stress

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Intake, Milk Yield, and Milk Composition by Stocking Rate (Miner Institute)

	Stocking Rate, %					
Item	100	113	131	142	SE	*P* - value
DMI[1], kg/d	24.4	24.8	25.0	25.3	0.65	0.69
Milk, kg/d	41.4	40.7	41.5	41.1	0.32	0.39
Fat, %	3.84[a]	3.77[ab]	3.77[ab]	3.67[b]	0.05	0.03
Protein, %	3.05	3.03	3.03	3.03	0.02	0.66
Lactose, %	4.89	4.88	4.90	4.90	0.01	0.42
SCS[2]	3.2	3.1	3.4	3.6	0.39	0.62

[1] DIM = Dry matter intake
[2] SCS = Somatic cell score
[a,b] Means within rows with different superscripts differ ($P < 0.05$)

Many non-nutritional factors affect milk fat

- Genetics/breed
- Days in milk
- Season
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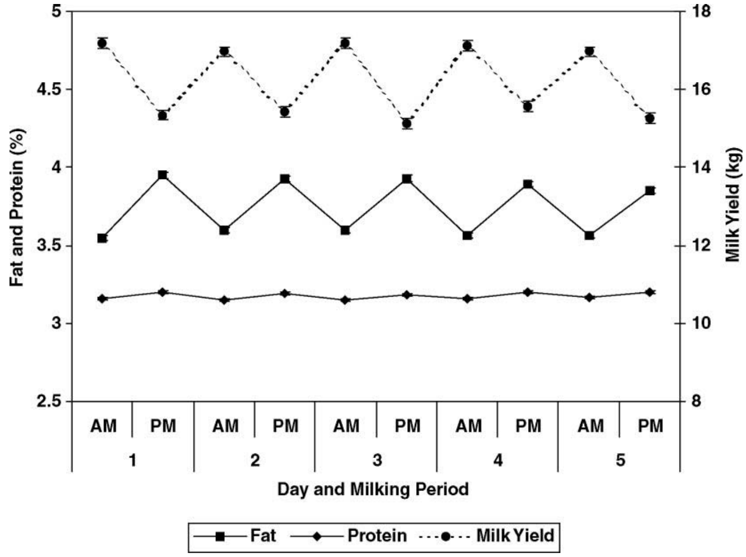
- Feeding patterns/stocking density
- Sampling strategy/analytical methods

Variation in milk yield and milk fat and protein content by milking for herds milking 2X



Quist et al., 2008. J. Dairy Sci. 91:3412–3423

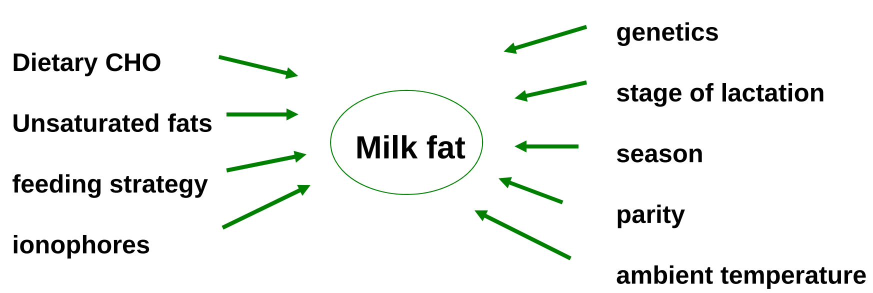
Many non-nutritional factors affect milk fat

- Genetics/breed
- Days in milk
- Season
- Heat stress
- Feeding patterns/stocking density
- Sampling strategy/analytical methods

Summary opinion – these are responsible for variation in milk fat within a herd over time and among herds, but rarely, if ever are they the cause for low milk fat on farms

Many factors can affect milk fat

Nutritional Factors | **Non-nutritional Factors**



“Old” understanding of low milk fat

- Most commonly observed when grain overload/low forage diets
- Must relate to not enough fiber fermentation
  - Acetate produced from fiber fermentation is major building block for milk fat
  - If not enough fiber fermented, may not have enough acetate to make milk fat
  - Not well-supported by research
- Must relate to increased insulin in cows fed high energy diets promoting BCS accumulation
  - Not well-supported by research

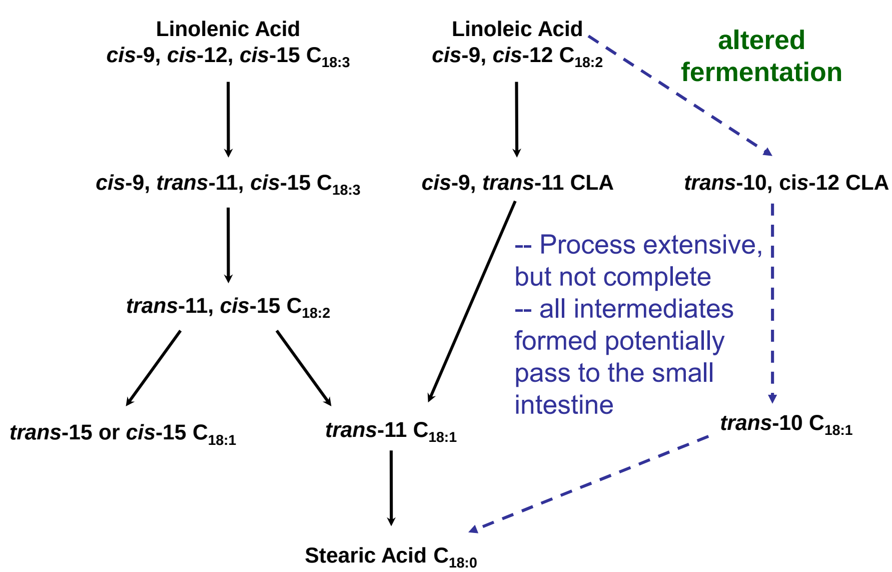
“New” understanding of low milk fat

- Not actually new
  - First advanced as a theory during 1970s
- Specific fats (fatty acids) produced during microbial metabolism of dietary fats in the rumen are responsible for low milk fat
- Very potent – 2 to 3 grams of these fatty acids flowing out of the rumen can decrease milk fat by 0.5% or more
- Mechanism for all situations of low milk fat appears to be the same, but get there in different ways

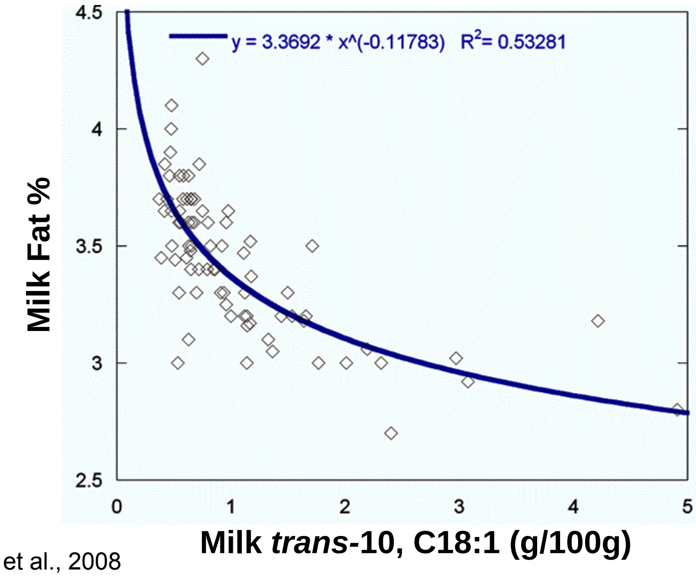
Fatty Acid Composition of Typical Feedstuffs

Feed Name	C14:0	C16:0	C16:1	C18:0	C18:1C	C18:2	C18:3
CrnSil6Cp60Ndf11LNdf	0.46	17.83	0.36	2.42	19.24	47.74	8.25
AlfSil17Cp43Ndf20LNdf	0.66	18.81	1.91	3.35	2.05	15.91	38.71
AlfHy17Cp46Ndf20LNdf	0.85	25.01	2.23	4.01	2.43	18.49	36.79
BakeryByProd	3.16	15.82	0.18	9.29	26.41	33.51	0.85
CornGrainCrkd	2.33	13.21	0.12	1.99	24.09	55.70	1.62
CornGrainGrndFine	2.33	13.21	0.12	1.99	24.09	55.70	1.62
CornHM22%Med	0.26	13.57	0.19	1.83	25.99	55.08	1.64
FatTallowBeef	3.00	24.43	3.79	17.92	41.62	1.09	0.53
FatCornOil	0.00	11.08	0.00	1.55	26.95	58.95	1.10
FatSoybeanOil	0.11	10.83	0.14	3.89	22.82	53.75	8.23
Megalac	1.60	50.80	0.00	4.10	35.70	7.00	0.20
EnergyBooster	2.90	40.00	0.62	40.70	10.40	1.80	0.00
CornDistEthanol	0.14	14.05	0.13	2.39	24.57	56.11	1.68
CottonseedWhlwLint	0.69	23.91	0.55	2.33	15.24	56.48	0.19
SoybeanMealExtrd	0.07	11.55	0.09	3.71	18.13	54.77	9.52
ClvrSil17Cp53Ndf15LNdf	0.33	15.22	1.52	2.38	2.62	18.19	53.84
GrssSil7Cp72Ndf13Lndf	0.54	16.76	1.67	1.94	3.80	19.96	44.30
GrssHy16Cp55Ndf6Lndf	0.43	16.44	0.48	1.33	2.53	23.38	49.90

Rumen Biohydrogenation

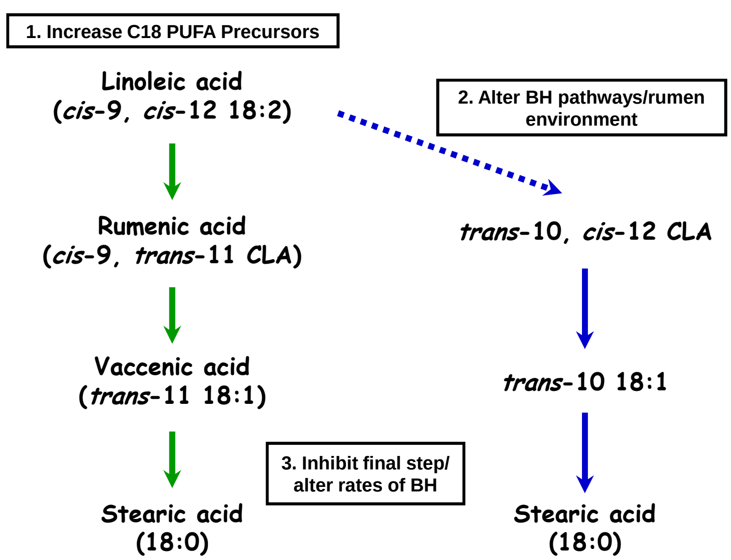


Relationship Between Milk t10 C18:1 Content & Milk Fat %

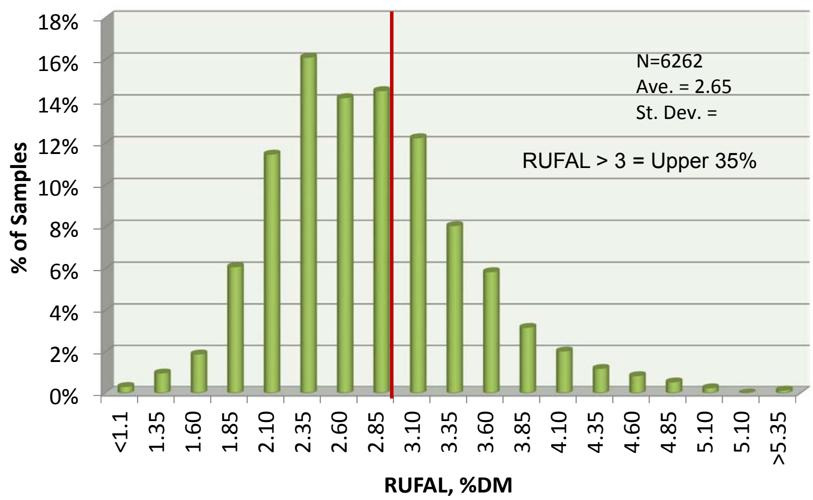


Overton et al., 2008

Dietary components can impact the risk of MFD in 3 ways



Distribution of Rumen Unsaturated Fatty Acid Load (RUFAL), %DM in Production TMR, CVAS 2015

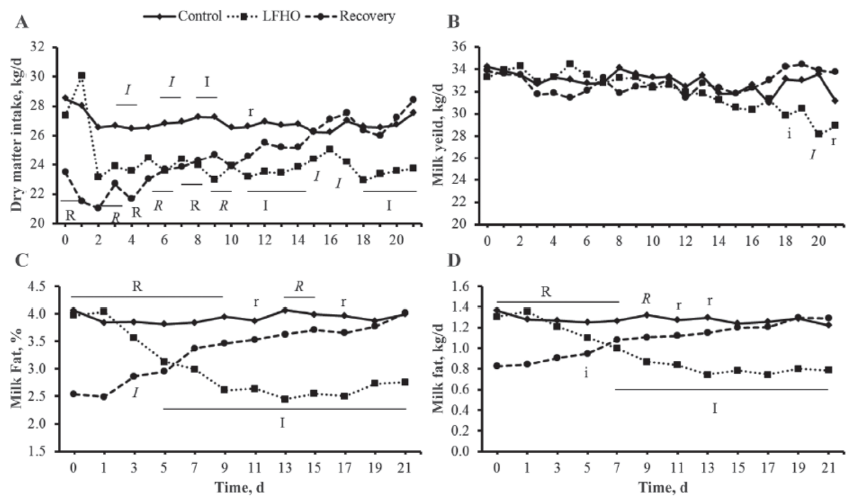


Slide courtesy Dr. Tom Jenkins

Common risk factors for low milk fat

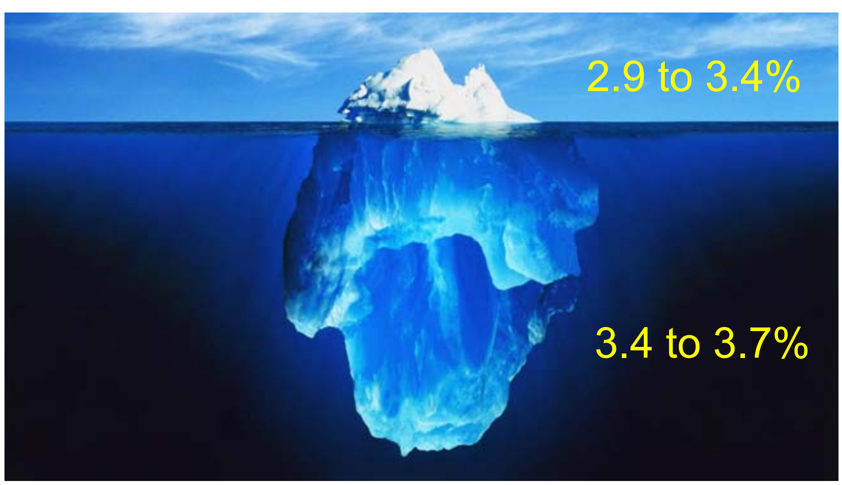
- Factors that cause altered ruminal biohydrogenation
  - NDF and NFC interrelationships
  - Altered corn silage fermentation profiles?
  - Mycotoxins in forages or high moisture corn?
  - Elevated mold/yeast counts in high-moisture corn or silages?
  - Oxidized components of feedstuffs?
- Factors that result in high availability of linoleic acid
  - Unsaturated fat source, amount, and processing
- Factors that slow rates of biohydrogenation
  - Fish fatty acids
  - Ionophores
  - High C18:1 intake?
- Factors that result in high rates of passage
  - High production/DMI
- Most often not one factor, but an INTERACTION AMONG SEVERAL FACTORS, responsible for milk fat problems

Time courses during induction and recovery from milk fat depression



Rico and Harvatine, 2013. J. Dairy Sci. 96 :6621–6630

Should we think about risk factors for low milk fat based upon the severity of the issue?



If acutely low milk fat (< 3.4%) ….

- Linoleic acid issues
- Yeasts on silage or high moisture cereals
- Mycotoxins
- EPA/DHA
- Severe rumen pH issues

If subacutely low milk fat (3.4 to 3.7%) ….

- Could be a lesser version of issues that cause acute low milk fat
- Could also be
  - C18:1
  - Overstocking/feedbunk mgt/factors that alter feeding patterns
  - Particle size/passage rate/DMI

What might we do nutritionally to increase milk fat percentage and yield when milk fat content is “normal”??

Specific nutritional supplements and additives that may increase milk fat percentage and yield

- Many nutritional supplements and feed additives exert their effects on milk fat yield through effects on milk yield rather than on milk fat percentage per se
- Some additives can have effects on milk fat percentage and yield
  - Buffers
  - DCAD
  - Yeast/yeast culture
  - AA analogs
  - Certain added fat sources (especially those high in palmitate C16:0)

Rumen buffers

- Maintain more stable rumen pH
- May increase liquid passage rate
- Examples
  - Sodium bicarbonate
  - Sodium sesquicarbonate (SQ-810)
  - Magnesium oxide

Meta analysis (40 publications)

- Rumen buffer supplementation (per % unit)
  - Increased DMI (0.5 kg/d)
  - Increased milk yield (0.5 kg/d)
  - Increased milk fat % (0.15%)
  - Increased ruminal pH (0.07 units)
  - Responses strongly linked to initial conditions
    - Greater in subacute acidosis situations

Meschy et al., 2004

Rumen buffers and biohydrogenation (Cabrita et al., 2009)

- Diets
  - 45% corn silage
  - 5% wheat straw
  - 50% wheat- or corn-based concentration
  - With and without buffer (0.15 kg bicarb and 0.11 kg MgOx)
- Buffer addition decreased milk fat content of BH intermediates

Dietary DCAD and milk fat

- Focus has been on *increasing* dietary DCAD for lactating cows (instead of *decreasing* DCAD as we do for dry cows)
- Hu and Murphy (2004) meta analysis
  - 17 trials, 69 dietary treatments
  - DCAD (Na + K – Cl)
  - Quadratic increases in yields of milk, fat, and protein with increasing DCAD
  - No relationship with milk fat or protein percentages

Performance of cows fed diets containing either 1.2% K or 2.0%K from potassium carbonate

Item	Control	DCAD+	SEM	P, treatment
DMI, kg/d	26.0	26.7	0.9	0.35
Milk, kg/d	39.5	41.6	1.6	0.20
Fat, kg/d	1.58	1.77	0.8	0.10
Protein, kg/d	1.16	1.15	0.42	0.94
Fat, %	4.01	4.38	0.10	0.01
Protein, %	2.95	2.78	0.05	0.01

Harrison et al., 2012. J. Dairy Sci. 95:3919-3925

Yeast/yeast culture

- Many different types/strains available in the marketplace
- Most have data showing positive effects on milk composition, at least in some situations
- Very difficult to decipher interactions of individual products with dietary factors on milk components

Saccharomyces cerevisiae meta analysis

- 110 papers, 157 experiments, and 376 treatments
- SC supplementation
  - Increased ruminal pH (0.03 units)
  - Decreased lactic acid concentration (-0.9 mM)
  - Increased total tract OM digestibility (0.8%)
  - Increased DMI (0.44 g/kg BW)
  - Increased milk yield (1.2 g/kg BW)
  - Tended to increase milk fat content (0.05%)
  - No influence on milk protein content
- Positive effect on pH increased with concentrate level and DMI

Desnoyers et al., 2009

Weighted average responses of cows to additional Met provided by experimental infusion or feeding protected forms or a Met analog

Item	DL-Met	HMTBa (Alimet)	Mepron	Smartamine	P
DMI, kg/d	+0.12[ab]	+0.15[a]	-0.25[b]	+0.31[a]	0.012
Milk, kg/d	-0.34	+0.28	+0.31	-0.13	0.055
Milk protein, g/d	+19[ab]	+13[b]	+35[a]	+19[ab]	<0.001
Milk protein, %	+0.08[a]	0.00[b]	+0.07[a]	+0.07[a]	<0.001
Milk fat, g/d	+12[ab]	+45[a]	+35[ab]	+6[b]	<0.001
Milk fat, %	+0.08[ab]	+0.13[a]	+0.05[b]	+0.04[b]	<0.001
(Protein+fat)/DMI	+0.78[b]	+1.70[ab]	+3.88[a]	-.0.42[b]	<0.001

Zanton et al., 2014. J. Dairy Sci. 97:7085-7101

Effect of feeding high palmitic acid fat supplements (> 85% C16:0) on DMI, milk yield, and milk composition

Study	DMI, kg/d	Suppl. C16:0	Milk, kg/d	Fat, %	Protein, %
Mosley et al. 2007					
Control	23.3 a	0	30.9 a	3.44 a	2.98
Treatment	26.4 b	412	34.0 b	3.93 b	2.97
Warntjes et al. 2008					
Control	26.2	0	36.7	3.75 a	2.96
Treatment	26.4	384	38.0	3.60 b	2.99
Rico and Harvatine, 2011					
Control	25.3 a	0	28.8	3.86	3.19
Treatment	23.0 b	394	29.0	3.92	3.14
Rico and Harvatine, 2011					
Control	28.3 a	0	41.5	3.14	3.14
Treatment	26.4 b	449	42.0	3.22	3.17
Lock et al., 2013					
Control	24.7 a	0	32.0	3.88 a	3.33 a
Treatment	23.3 b	361	32.0	4.16 b	3.28 b
Piantoni et al., 2013					
Control	27.8	0	44.9 b	3.29 a	3.11
Treatment	27.8	545	46.0 b	3.40 b	3.09

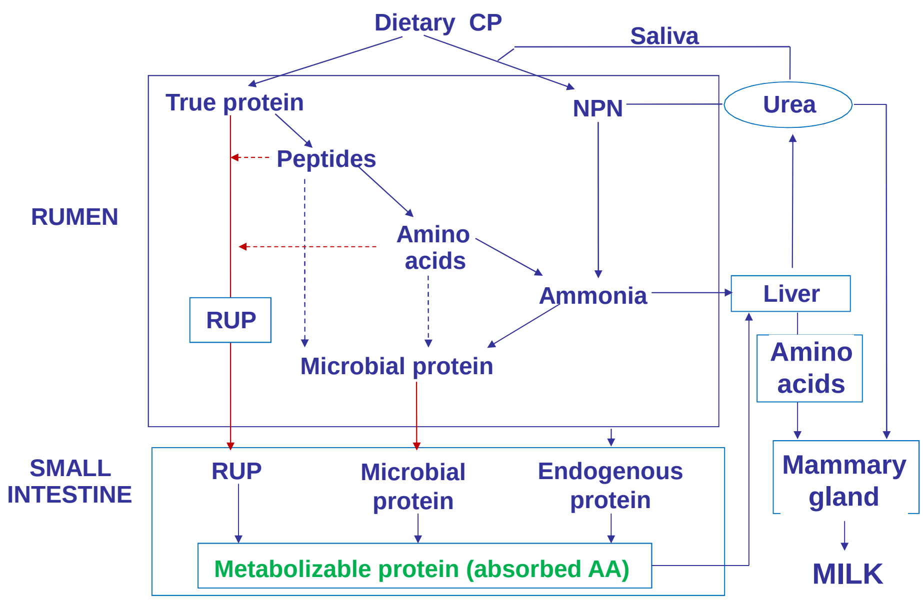
Adapted and updated from Loften et al., 2014. J. Dairy Sci. 97:4661-4674

Specific nutritional supplements and additives that may increase milk fat percentage and yield

- Many nutritional supplements and feed additives exert their effects on milk fat yield through effects on milk yield rather than on milk fat percentage per se
- Some additives can have effects on milk fat percentage and yield
  - Buffers
  - DCAD
  - Yeast/yeast culture
  - AA analogs
  - Certain added fat sources (especially those high in palmitate C16:0)

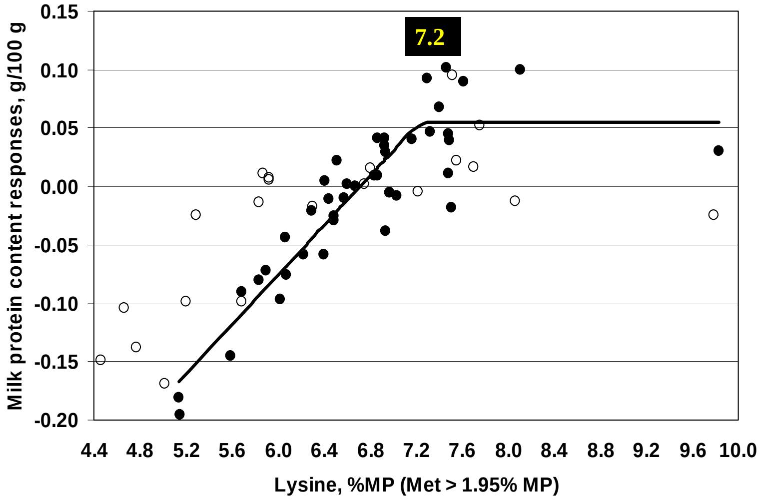
What about milk protein?

Protein metabolism in cows

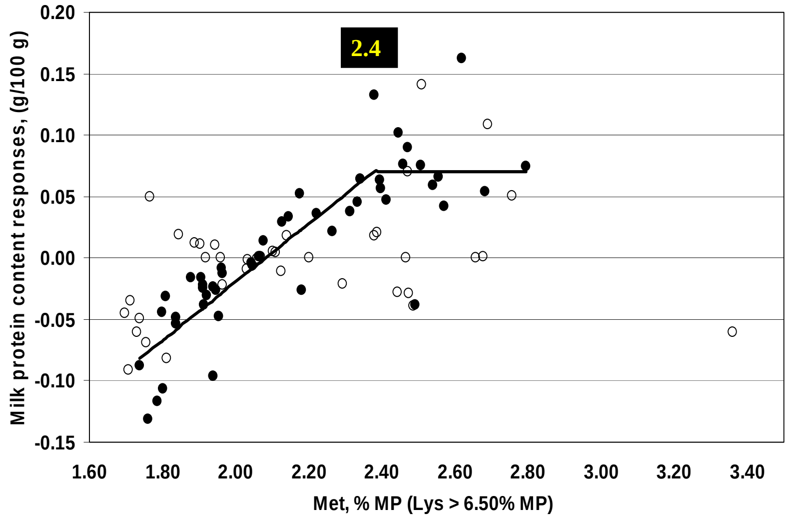


Schwab, 2005

Lysine Plot (NRC, 2001)



Methionine Plot (NRC, 2001)



Optimum AA concentrations in MP in CNCPS 6.5.5 biology

	Lysine	**Methionine**	**Optimal Lys/Met**
	AMTS/NDS (CNPS 6.5 biology) milk protein yield		
2015	7.00	2.60	**2.7**
	AMTS/NDS (CNCPS 6.5 biology) milk protein %		
2015	6.77	2.85	**2.4**

Van Amburgh (2015)

How digestible are your RUP sources?

Quality Blood Meal

Cornell RUP and Undigested CP Report

DAIRYLAND Laboratories, Inc.

Date: 11/5/2015
Account # 298-51
Sample # 50541

Sampled By: Vita Plus
Sampled For: Vita Plus

Moisture 8.15%
Dry Matter 91.85%

Description		Total Feed CP % DM	Estimated RUP % CP	Undigested CP % CP
Description:	blood meal	97.51	92.77	5.11

Estimated percent CP digested by compartment.

Description		Rumen	Intestine	Total
Description:	blood meal	7.23	87.66	94.89

The estimated RUP and undigested CP is a method developed by Cornell University using an invitro procedure incubated at 16 hours and corrected for microbial contamination. The undigested CP is estimated using an enzyme mix of trypsin, chymotrypsin, amylase and lipase and percent crude protein digested by compartment.

RUP % CP

Product	Average	Min	Max
Blood Meal	93.4	86.4	97.9
Bypass Soy	68.2	62.6	88.9
SBM	47.8	31.6	73.8
Distillers Grains	76.6	62.3	94.2
Canola Meal (all types)	41.5	27	52.3

Undigested CP % CP

Product	Average	Min	Max
Blood Meal	16.8	0.0	59.2
Bypass Soy	5.6	3.3	10.4
SBM	3.7	1.4	6.9
Distillers Grains	20.9	7.8	56.2
Canola Meal (all types)	9.6	8.3	13.6

VITA PLUS

Rumen Protected Methionine (RPM): Meta-Analysis

Patton et al., 2010. J. Dairy Sci. 93 :2105–2118

- Studies
  - 17 for Mepron
  - 17 for Smartamine
  - 1 Study for both
- 75 diet comparisons
  - 1040 individual cows
- Average of 20 g RP-Met/d
  - 12 g metabolizable Met

Courtesy Dr. Sarah Boucher

Patton R.A., 2010

Patton, 2010. J. Dairy Sci. 93 :2105–2118

Item	Mean	Min.	Max.
DMI, kg	-0.04	-2.10	1.50
Milk, kg	0.02	-4.20	4.40
Milk true protein, %	0.07	-0.09	0.35
Milk true protein, kg	0.03	-0.07	0.19
Milk fat, %	-0.01	-0.30	0.41
Milk fat, kg	0.01	-0.19	0.19

Courtesy Dr. Sarah Boucher

Patton, R.A., 201

Weighted average responses of cows to additional Met provided by experimental infusion or feeding protected forms or a Met analog

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Milk, kg/d	-0.34	+0.28	+0.31	-0.13	0.055
Milk protein, g/d	+19[ab]	+13[b]	+35[a]	+19[ab]	<0.001
Milk protein, %	+0.08[a]	0.00[b]	+0.07[a]	+0.07[a]	<0.001
Milk fat, g/d	+12[ab]	+45[a]	+35[ab]	+6[b]	<0.001
Milk fat, %	+0.08[ab]	+0.13[a]	+0.05[b]	+0.04[b]	<0.001
(Protein+fat)/DMI	+0.78[b]	+1.70[ab]	+3.88[a]	-.0.42[b]	<0.001

Zanton et al., 2014. J. Dairy Sci. 97:7085-7101

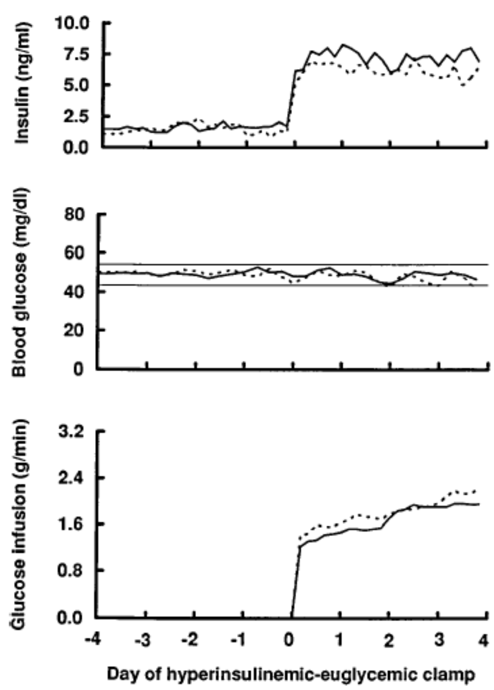
What if we could improve milk protein synthesis without changing AA intake?

Role of energy nutrition in milk protein synthesis

- Sporndly (1989) reported much stronger relationship of milk protein percentage with dietary energy intake than dietary protein intake
  - Often attributed to ruminal fermentation and microbial protein synthesis
  - Sugars, starches, and digestible fiber sources will drive microbial protein yield

Effects of insulin on milk protein

- Hyperinsulinemic-Euglycemic clamps
  - Clamp alone
    - 15% increase in milk protein yield (Mackle et al., 1999)
  - Clamp w/ abomasal infusion of casein
    - 28% increase in milk protein yield (Griinari et al., 1997)
  - Clamp w/ abomasal infusion of BCAA & casein
    - 25% increase in milk protein yield (Mackle et al., 1999)
  - Clamp w/ IV infusion of AA (casein profile)
    - Insulin and insulin plus AA increased milk by 13 to 18% and protein by 10 to 21% in goats
      - (Bequette et al, 2001)



Hyperinsulinemic-euglycemic clamp

(Griinari et al., 1997)

Dashed line – water infusion
Solid line – 500 g/d casein

Long-acting insulins and milk protein

- 30 multiparous Holstein cows
  - 52 to 130 DIM, avg. 88 +/- 25
- 3 treatments given at 12-h intervals for 10 d
  - Control
  - 0.2 IU/kg of BW Humulin-N (Eli Lilly and Co.), 2X/d
  - 0.2 IU/kg of BW Insulin glargine (Sanofi-Aventis), 2X/d
- Blood samples
  - Twice daily from coccygeal vein
  - Before morning injections, 6 hours later
- Milk samples every other day, 2x/d

Winkelman and Overton, 2013. J. Dairy Sci. 96:7565-7577.

Basal Diet, DM basis; CNCPS 6.1

Ingredient, %	Content
Corn silage	46.65
Ground corn	15.54
Wheat straw	6.89
Corn germ meal	5.22
Corn distillers	5.18
Canola meal	5.14
Amino Plus [1]	4.68
Minerals and vitamins [2]	2.97
Soybean meal	1.71
Blood meal	1.64
Citrus pulp, dry	1.60
Energy Booster [3]	1.10
Molasses	0.69
AminoShure-L [4]	0.50
Urea	0.34
Alimet [5]	0.08
Smartamine-M [6]	0.08

Energy and nutrients [7]	
NEL, Mcal/kg	1.67
NDF, %	34.8
NFC, %	42.3
Starch, %	30.5
Crude fat, %	3.8
ME allowable milk,[8] kg/d	47.7
MP allowable milk,[8] kg/d	49.3
MP supply,[8] g/d	3,255
Lys,[8] % of MP	7.33
Met,[8] % of MP	2.54
CP, %	15.2

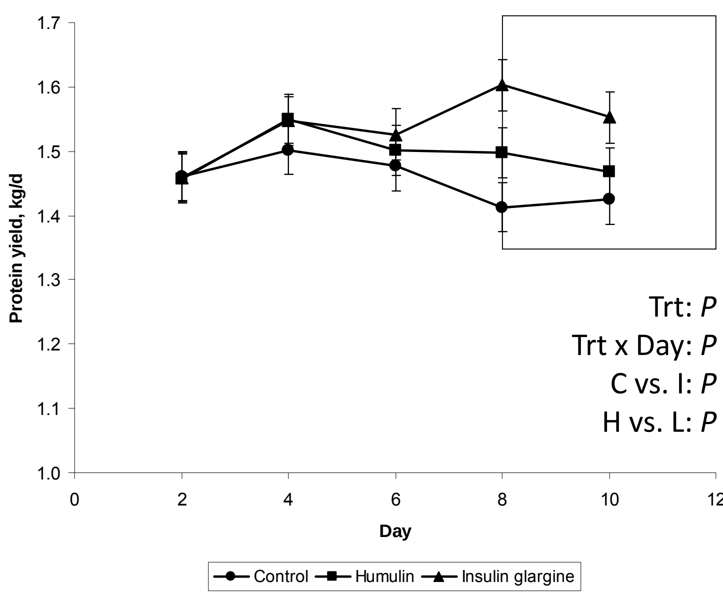
Winkelman and Overton, 2013. J. Dairy Sci. 96:7565-7577.

DMI, milk yield, and milk composition for cows administered two forms of long-acting insulin

	Treatment					P-value				
Variable	C	H	L	SE		Trt	Day	Trt x Day	C vs. I	H vs. L
DMI, kg/d	26.4	26.2	26.8	0.4		0.58	<0.001	0.57	0.82	0.31
Milk yield, kg/d	48.3	47.3	47.1	0.9		0.46	0.12	0.29	0.27	0.86
Fat, %	3.17	3.32	3.50	0.11		0.12	0.08	0.28	0.09	0.24
Fat yield, kg/d	1.50	1.55	1.65	0.05		0.13	0.21	0.83	0.11	0.22
Protein, %	3.00	3.20	3.29	0.04		0.001	<0.001	0.42	<0.001	0.20
Protein yield, kg/d	1.46	1.49	1.54	0.03		0.08	0.001	0.08	0.06	0.22
Lactose, %	4.84	4.76	4.70	0.02		0.001	0.13	0.25	<0.001	0.10
Lactose yield, kg/d	2.34	2.26	2.21	0.04		0.07	0.04	0.06	0.03	0.39
Total solids, %	11.95	12.09	12.42	0.14		0.06	0.02	0.28	0.08	0.10
Total solids yield, kg/d	5.77	5.68	5.82	0.13		0.63	0.13	0.61	0.88	0.34
ECM, kg/d	46.8	46.5	48.3	1.1		0.50	0.08	0.62	0.68	0.27
SCC (x 1,000)[7]	62	44	113	24		0.12	0.18	0.26	0.57	0.05
MUN[8], mg/dL	13.5	12.5	12.3	0.5		0.01	<0.001	0.08	0.004	0.61

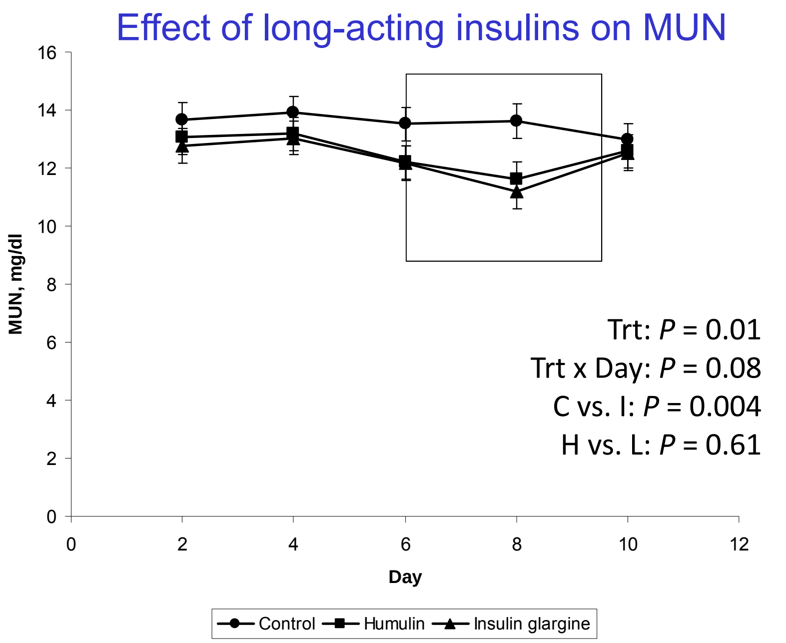
Winkelman and Overton, 2013. J. Dairy Sci. 96:7565-7577.

Effect of long-acting insulins on milk protein yield

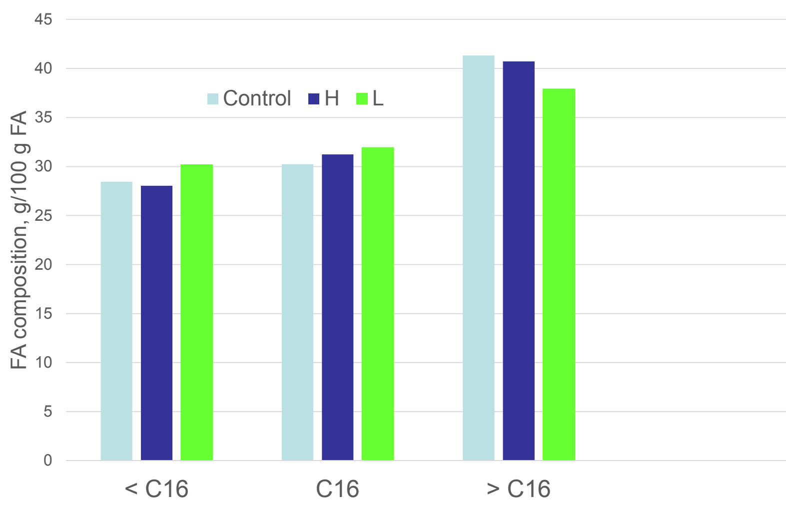


Trt: $P = 0.08$
Trt x Day: $P = 0.08$
C vs. I: $P = 0.06$
H vs. L: $P = 0.22$

Winkelman and Overton, 2013. J. Dairy Sci. 96:7565-7577.



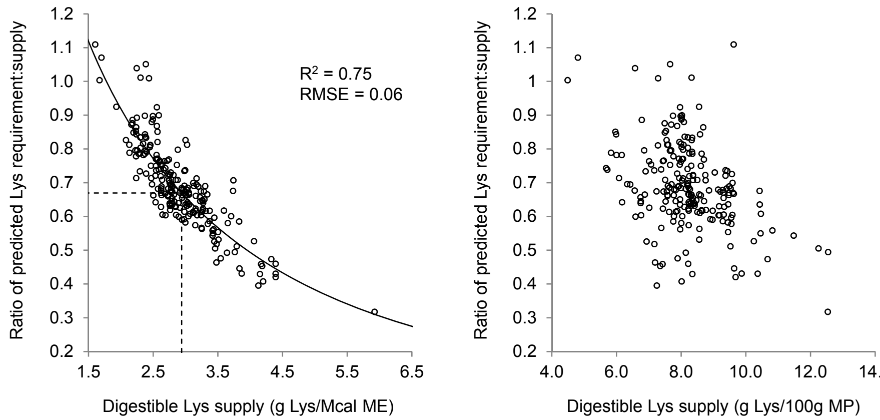
Winkelman and Overton, 2013. J. Dairy Sci. 96:7565-7577.



Milk FA composition for cows administered control (C) or two forms (H or L) of long-acting insulin. $P < 0.05$ for effects of treatment on < C16 and > C16. SEM = 0.9, 0.8, and 1.5 for < C16, C16, and > C16, respectively

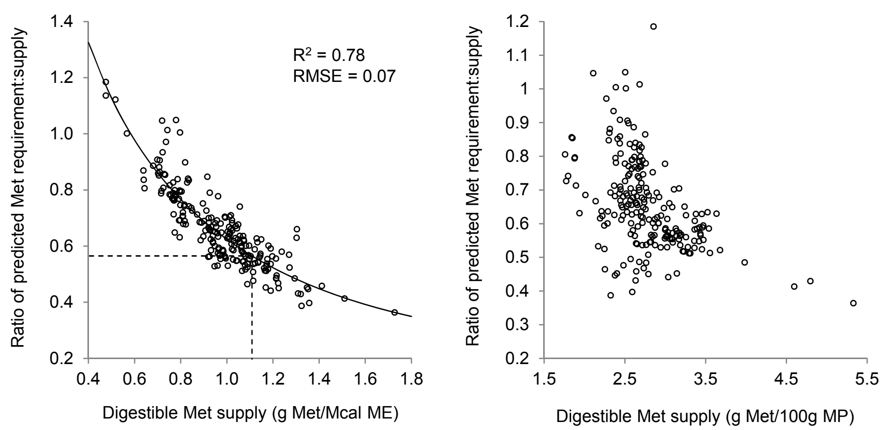
Winkelman and Overton, 2013. J. Dairy Sci. 96:7565-7577.

Lys Use Expressed Relative To Metabolizable Energy Or Metabolizable Protein



Slide courtesy Dr. Mike Van Amburgh

Methionine Use Expressed Relative To Metabolizable Energy Or Metabolizable Protein



Slide courtesy Dr. Mike Van Amburgh

Optimum Supply Of Each EAA Relative To Metabolizable Energy (Van Amburgh et al., 2015)

AA	R^2	Efficiency from our evaluation	Lapierre et al. (2007)	g AA/ Mcal ME	% EAA
Arg	0.81	0.61	0.58	2.04	10.2%
His	0.84	0.77	0.76	0.91	4.5%
Ile	0.74	0.67	0.67	2.16	10.8%
Leu	0.81	0.73	0.61	3.42	17.0%
Lys	0.75	0.67	0.69	3.03	15.1%
Met	0.79	0.57	0.66	1.14	5.7%
Phe	0.75	0.58	0.57	2.15	10.7%
Thr	0.75	0.59	0.66	2.14	10.7%
Trp	0.71	0.65	N/A	0.59	2.9%
Val	0.79	0.68	0.66	2.48	12.4%

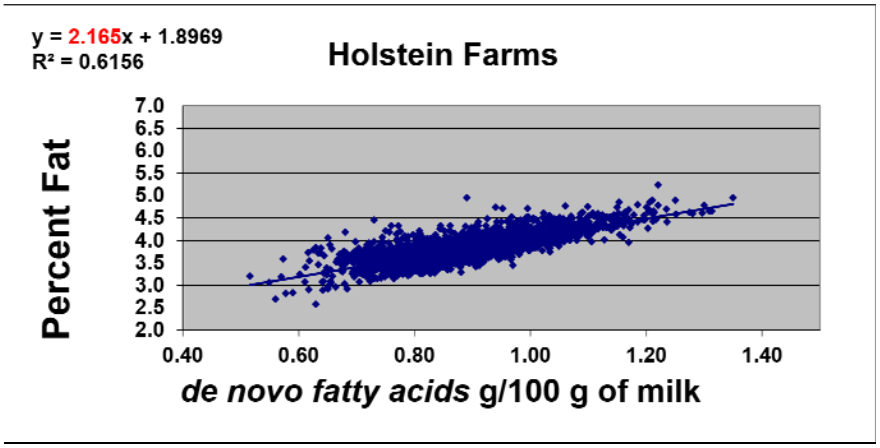
Lys and Met requirements 14.9%, 5.1% - Schwab (1996)

Lys and Met requirements 14.7%, 5.3% - Rulquin et al. (1993)

Field implication – more glucogenic/propiogenic rations may support greater responses to AA supplementation?

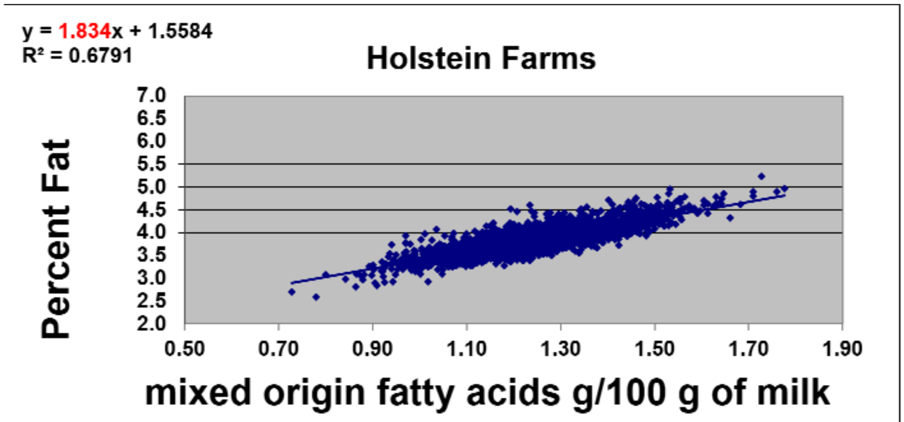
What about potential use of milk infrared (FTIR) technologies to assess milk fatty acid composition and optimize components?

Bulk Tank – 430 farms – 15 months



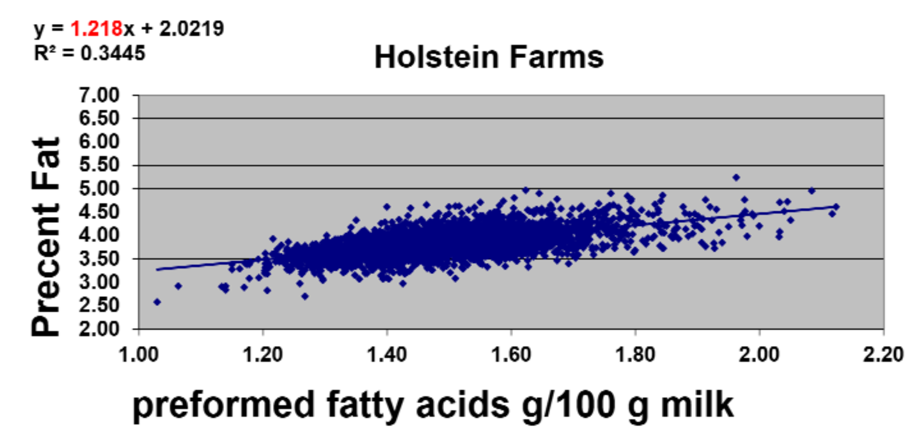
Barbano and Mellili, 2016

Bulk Tank – 430 farms – 15 months



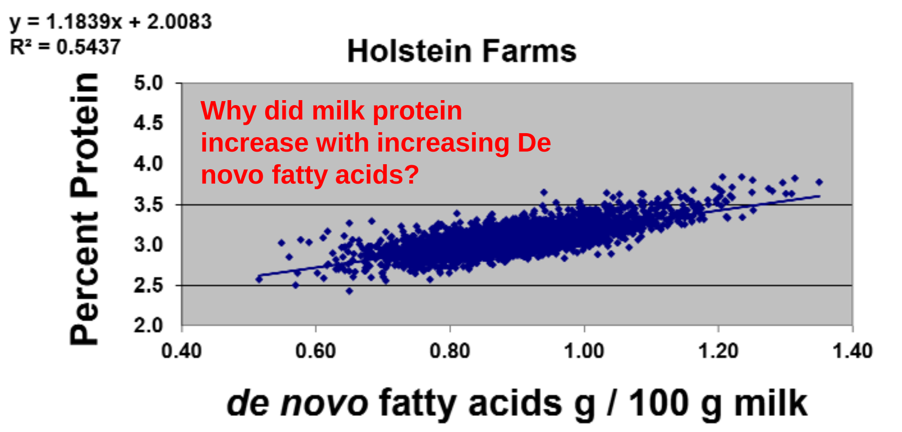
Barbano and Mellili, 2016

Bulk Tank – 430 farms – 15 months



Barbano and Mellili, 2016

Bulk Tank – 430 farms – 15 months



Barbano and Mellili, 2016

Table 7. Least squares means of milk composition covariately adjusted by the percentage of Holsteins for high de novo (HDN) and low de novo (LDN) farms for the month of the farm visit

Item	HDN	LDN	SEM	P-value
Milk kg/d	26.3	22.7	1.3	0.06
Fat, kg/d	1.1	0.9	0.1	0.01
Fat, %	4.33	4.14	0.08	0.10
True protein, kg/d	0.89	0.73	0.04	<0.01
True protein, %	3.41	3.22	0.04	<0.01
De novo fatty acids[1]				
g/100 g of milk	1.06	0.94	0.02	<0.01
g/100 g of fatty acids	25.61	23.71	0.19	<0.01
g/d	269.8	207.3	12.9	<0.01
Mixed fatty acids[2]				
g/100 g of milk	1.60	1.50	0.03	0.03
g/100 g of fatty acids	38.86	37.98	0.26	0.02
g/d	411.9	329.7	20.0	<0.01
Preformed fatty acids[3]				
g/100 g of milk	1.45	1.51	0.02	0.04
g/100 g of fatty acids	35.53	38.31	0.31	<0.01
g/d	376.4	333.4	19.2	0.12
MUN, mg/dL	11.4	11.3	0.5	0.89
Anhydrous lactose, %	4.60	4.59	0.02	0.66
Anhydrous lactose, kg/d	1.22	1.05	0.06	0.07

[1]C4 to C14.
[2]C16, C16:1, and C:17.
[3]Greater than or equal to C18.

Woolpert et al., 2016. J. Dairy Sci. 99:8486-8497.

Table 9. Least squares means of management factors for high de novo (HDN) or low de novo (LDN) farms observed or recorded during the farm visit. Percentage of Holsteins was included in the model as a covariate when $P < 0.05$

Item	HDN	LDN	SEM	*P*-value
Cows milking,[1] no.	105	108	19	0.93
DIM	165	179	36.4	0.88
Bunkspace,[1,2] cm/cow	50.6	42.4	3.6	0.13
Stall stocking density,[2] cow/stall	1.05	1.20	0.05	0.05
Tiestall feeding frequency per day	4.6	2.9	0.7	0.05
Feed push-up frequency per day				
Tiestall	1.3	3.5	0.9	0.06
Freestall	2.7	4.8	0.9	0.10
BCS	3.08	2.96	0.03	0.002

[1]Covariate adjusted means.

[2]Only applicable to farms with freestall-housed lactating cows (n = 23).

Woolpert et al., 2016. J. Dairy Sci. 99:8486-8497.

Table 10. Nutritional characteristics of weighted average of TMR from high de novo (HDN) and low de novo (LDN) farms

Item	HDN	LDN	SEM	*P*-value
DM, %	42.2	38.9	2.1	0.24
CP, % of DM	15.1	16.0	0.6	0.24
ADF, % of DM	22.7	23.7	1.1	0.50
NDF, % of DM	37.4	38.7	1.4	0.48
Starch, % of DM	23.1	20.2	1.5	0.15
Ether extract, % of DM	3.7	4.4	0.1	<0.01
Ash, % of DM	8.3	8.9	0.4	0.24
Forage, % DM	58.1	57.8	0.1	0.51

Woolpert et al., 2016. J. Dairy Sci. 99:8486-8497.

Can we use FTIR technologies to gauge what the milk component potential might be within an individual herd?

Thanks!!

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