You Control Milk Fat Depression –Don't Let It Control You

Tom Jenkins PhD
Professor Emeritus
Clemson University

tjnkns@clemson.edu

Becoming a Victim to MFD

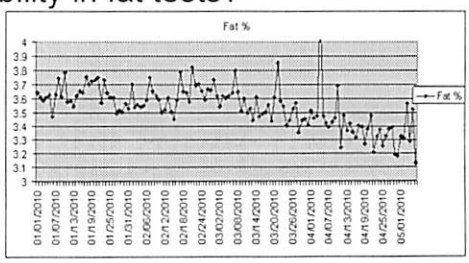
- One or more management weak links
- You are doing everything right, BUT
  - responding to changes in feed prices
  - limited availability of some feed ingredients
  - unexpected changes in nutrient composition of feed ingredients

Is This the Right Time to Battle MFD?

- Am I satisfied with the herd's milk fat production and should I take the risk of messing up a good thing?
- I've seen a drop in milk fat percentage but is the drop in lbs of fat really large enough to affect my milk check?

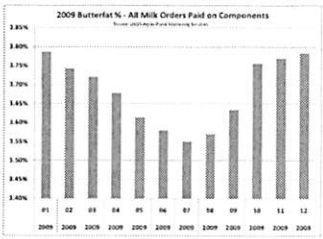
Is This the Right Time to Battle MFD?

- I've seen a drop in milk fat recently but is it a sustained trend or just part of the normal variability in fat tests?



Is This the Right Time to Battle MFD?

- Is the drop in fat test I've seen a nutritional problem or could it be regular seasonal changes in lactation that occurs each year?



Cause of MFD

- MFD is caused by nutrition-driven changes in the rumen.
- Lipids in feed are metabolized by the rumen microbial population
  - leads to the formation of bioactive lipids.
  - bioactive lipids are referred to as conjugated linoleic acid or CLA

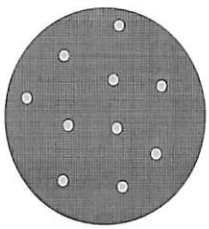
Unsaturated fatty acids

Saturated fatty acids

	Intake g/d	Lipolysed g/d	Duodenal g/d
C12:0	10.56	10.22	10.56
C14:0	13.27	11.10	13.27
C16:0	290.36	226.67	297.06
C16:1	4.65	4.57	4.76
C18:0	35.06	29.31	597.68
C18:1T	0.84	0.76	109.35
C18:1C	233.96	188.13	81.15
C18:2	495.57	477.97	51.32
C18:3	58.93	57.31	2.95
Other	18.21	17.33	58.88
Ration	1161.40	1023.37	1226.96

Rumen Input of FA in Cows Fed Fish Oil

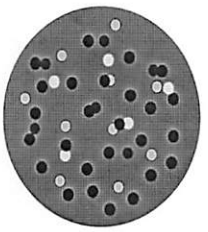
From J. Nutr. 2012. 142:1437-1448.

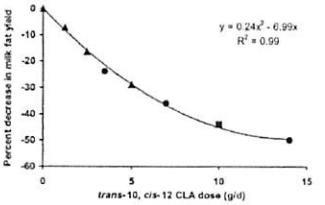


- Feed C16 and C18 Sat\Unsat (n=10)

Rumen Output of FA in Cows Fed Fish Oil

From J. Nutr. 2012. 142:1437-1448.





CLA_{MFI} (n=3)

- Feed
- Microbial trans FA (n=5)
- Microbial CLA (n=7)
- Microbial fish FA (n=28)

Important Points About CLA

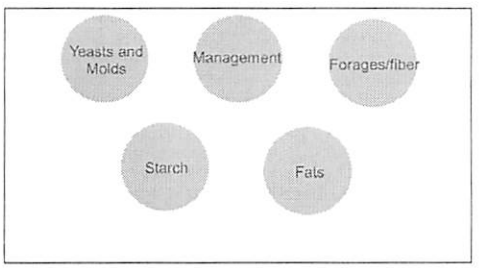
CLA - bioactive lipids made by microorganisms in the rumen from unsaturated fatty acids in the feed.

CLA_{MFI} – the three CLA produced in the rumen that are milk fat inhibitors and cause MFD.

The bottom line

FEED ⟹ RUMEN ⟹ CLA_{MFI} ⟹ MFD

Nutritional factors that affect the risk of MFD



FAT

Too much fat in the diet of dairy cows is a classic cause of MFD.

	CON	SBO
DMI, lb/d	47.3	43.6
Milk, lb/d	66.6	63.3
Milk fat, lb/d	2.46	1.87*
Milk fat, %	3.53	2.73*

*CON and SBO diets differed ($P < 0.05$).
From Huang et al., 2008. J. Dairy Sci. 91:260–270.

Temptations to push the limit on feeding fat

- When prices are favorable for high-fat byproducts
- When grain prices reach record levels making commercial fats more competitive
- When the farm has access to (perceptually inexpensive) high-fat waste products from a nearby food processing plant.
- **How high is too high??**

Resolve MFD – Manage Fat Intake

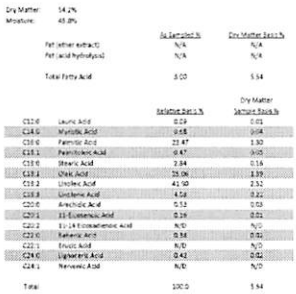
- The amount of fat fed is most important control point.
- Consider all sources of fat
  - Fat supplements including byproducts
  - Basal ingredients
- Adjust added fat accounting for
  - Fat contribution from grains and forages
  - Unsaturation of fat supplements
  - NDF in TMR

Rumen Unsaturated Fatty Acid Load

RUFAL

(C18:1 + C18:2 + C18:3)

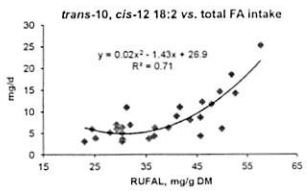
A Way to Account for All High Risk Fatty Acids



		As Sampled %	Dry Matter Basis %
Dry Matter:	54.2%		
Moisture:	45.8%		
	Fat (ether extract)	N/A	N/A
	Fat (acid hydrolysis)	N/A	N/A
	Total Fatty Acid	3.03	5.59
		Relative Part %	Dry Matter Sample Basis %
C12:0	Lauric Acid	0.29	0.01
C14:0	Myristic Acid	0.68	0.04
C16:0	Palmitic Acid	22.47	1.30
C16:1	Palmitoleic Acid	0.47	0.03
C18:0	Stearic Acid	2.84	0.16
C18:1	Oleic Acid	35.06	1.97
C18:2	Linoleic Acid	41.90	2.32
C18:3	Linolenic Acid	4.58	0.22
C20:0	Arachidic Acid	0.53	0.03
C20:1	11-Eicosenoic Acid	0.19	0.01
C20:2	11,14 Eicosadienoic Acid	N/D	N/D
C22:0	Behenic Acid	0.34	0.02
C22:1	Erucic Acid	N/D	N/D
C24:0	Lignoceric Acid	0.42	0.02
C24:1	Nervonic Acid	N/D	N/D
Total		100.0	5.54

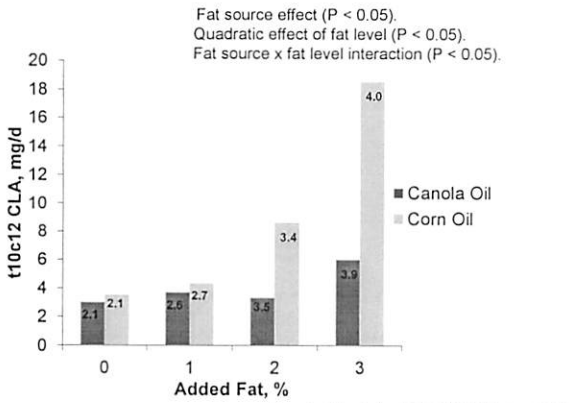
RUFAL = 3.93%

- RUFAL < 3.5%
  - Total FA intake on lower side
  - IF have MFD look for other causes first
  - Might have room for more fat if production numbers are good.
- RUFAL > 3.5%
  - Total FA intake on higher side
  - See where fat is coming from
  - Consider backing off a bit if MFD problems



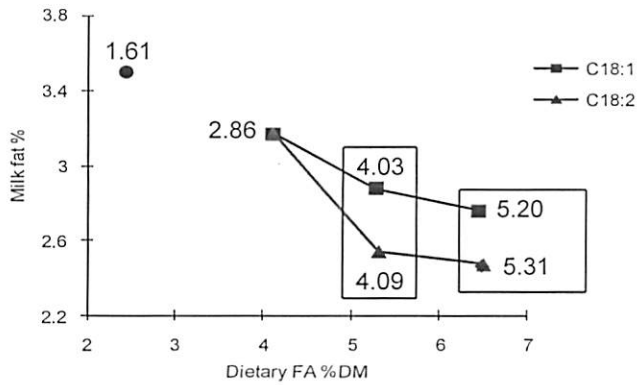
Sun, Jenkins, & Lock.2013 ADSA Abstract #656

See where fat is coming from!



Sun, Jenkins, & Lock.2013 ADSA Abstract #656

See where fat is coming from!



From He et al. (2012) J. Dairy Sci. 95:1447-1461.

Fatty Acids in Rye and Annual Ryegrass Pasture

Pasture	Planted	Grazed	Initial FA, % DM	Final FA, % DM
Rye	October	Nov 18- Mar 17	6.8	4.7
Annual ryegrass	October	Mar 17 – June 3	4.5	1.8

Freeman-Pounders et al. 2009. Forage and Grazinglands. doi: 10.1094/FG-2009-0130-01-BR.

Pay attention to Fat Limits

1. Limit the total fat consumed from all sources (basal ingredients plus fat supplements) so that
   lbs total fatty acid intake = lbs milk fat produced

2. Limit high-risk fats so that
   lbs. high-risk fatty acids = $\frac{4 * NDF * DMI}{UFA * 100}$

   Where,
   - NDF is % of the dairy TMR
   - DMI is dry matter intake of cows in lbs/day
   - UFA is % unsaturated fatty acids in the fat

http://virtusnutrition.com/. Click on the window labeled "**What's Your Fat Feeding Strategy?**"

Forage/Concentrate

- Particle Length
  - Bottom Pan of Penn State Shaker Box <47%
  - ~ 7% on top
- % forage >50%
- % forage NDF > 20%
- >50% cud chewing

Source of Forage

	Treatment		
	CS	CST	AST
DMI, lb/d	60.7	57.0	58.3
Milk, lb/d	98.8	97.5	95.9
Fat, %	3.12[a]	2.68[b]	3.32[a]
t10 18:1, %	0.75[b]	2.15[a]	0.78[b]

CS = 50% corn silage + 50% conc
CST = 50% corn silage + 50% conc + 2% tallow
AST = 25% corn silage + 25% alfalfa silage + 50% conc + 2% tallow

Onetti et al., 2004

Netherland Silage

- Previous research has reported significant variation in FA concentration of forages

FA, % DM	Grass Silage	Corn Silage
Mean	1.9	2.0
Minimum	0.8	1.2
Maximum	3.3	3.5

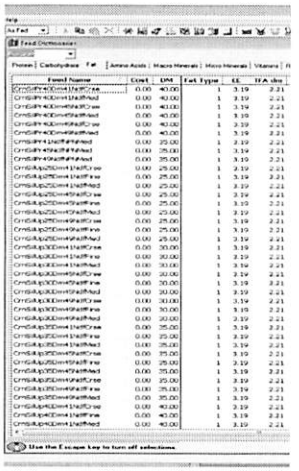
Khan et al., 2012 Anim Feed Sci Tech. 174: 36-45

USA Corn Silage-75 corn silage samples from 2011 harvest

	TFA, %DM
Mean	2.5
Min	1.6
Max	3.6

Klein, Ploetz, Jenkins, & Lock.2013 ADSA Abstract #73

Feed Libraries – use the same fat values for all corn silages



Ingredients	A.F. lbs	DM lbs
small grain mix baleage 12 2012	2.959	1.479
Clemson Corn Silage 2012 med fat	60.000	19.200
clemson hay	2.000	1.852
CornDistMedSprits	1.500	1.365
CornGrainGrndMed	3.149	2.772
Megalac	0.220	0.213
MolassesCane	0.750	0.547
pro itek	1.200	1.116
SoybeanML47.5Solv	5.999	5.399
Urea281CP	0.180	0.176
WheatMidds	3.499	3.114
CornFlyDry	5.999	5.313
SoybeanHullsPellet	5.999	5.459
clemson mix rs	2.167	2.139
Cottonseed Fuzzy	5.000	4.610
Totals	100.922	54.754

TFA c.s. % DM	TFA intake g/d	TFA % DM	Milk lb/d
1.6	980	3.94	86.1
3.6	1162	4.67	88.9

FFA Increase Risk of MFD

	FFA, % of total lipid		
	Fresh	Ensiled	Reference
Ryegrass	2	27-73	Elsgersma et al. 2003
Timothy	15	56	Vanhatalo et. al. 2007
Red Clover	8	45	Vanhatalo et. al. 2007

Plant lipases release FFA after cutting (Thomas, 1986) or during ensiling (Chow et al., 2004).

FFA in WCS

	WCS Source		
	Normal	No Heating	Overheated
Moisture, %	9.4	10.6	11.9
Oil, %	18.4	17.1	15.9
FFA, % of oil	6.8	24.1	22.3
DMI, kg/d			
Milk, kg/d			
Fat, %			

[ab] $P < 0.05$
Cooke et al. 2007. J. Dairy Sci. 90:2329.

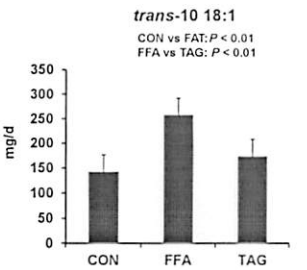
FFA in WCS

	WCS Source		
	Normal	No Heating	Overheated
Moisture, %	9.4	10.6	11.9
Oil, %	18.4	17.1	15.9
FFA, % of oil	6.8	24.1	22.3
DMI, lb/d	47.5	48.4	51.7
Milk, lb/d	77.0	74.8	77.2
Fat, %	4.22[a]	3.64[b]	3.58[b]

[ab] $P < 0.05$
Cooke et al. 2007. J. Dairy Sci. 90:2329.

USA Corn Silage-75 corn silage samples from 2011 harvest

	TFA, %DM	FFA, %TFA
Mean	2.5	20
Min	1.6	13
Max	3.6	31



Klein, Ploetz, Jenkins, & Lock.2013 ADSA Abstract #73

Higher Risk Corn Silage

- High rates of starch degradability reaching 85% or more in a 7-hour in vitro test.

Average and Range for Qualitative Evaluations of Corn Silage

ITEM	LOW - 2 SD	MED-LOW - 1 SD	AVERAGE	MED-HIGH + 1 SD	HIGH + 2 SD	SAMPLE
Starch Degradability, 7 HR	62.0	68.8	75.5	82.2	89.0	

Higher Risk Corn Silage

- High yeasts and molds. Alarms go off with yeast counts approaching 1 million cfu/g.

CUMBERLAND VALLEY ANALYTICAL SERVICES, INC. April 16, 2009
PO Box 669 Maugansville, MD 21767 301-790-1980 Sample No : 8980042

A N A L Y S I S R E S U L T S

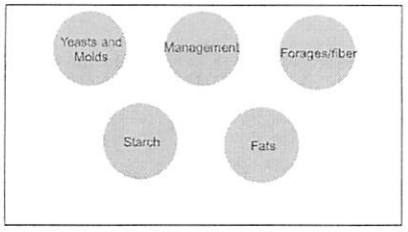
CORN SILAGE	As Sampled	Dry Matter	Unit
Moisture	73.7		%
Dry Matter	26.3		%

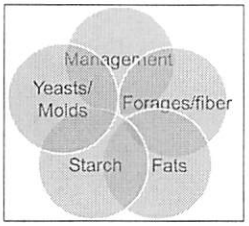
Mold and Yeast counts are on an as-received basis

Mold Count < 1000 col/gm

Yeast Count > 100,000,000 col/gm

Why Do I Still Sometimes Have MFD Problems Even When I Follow All The Proper Guidelines?



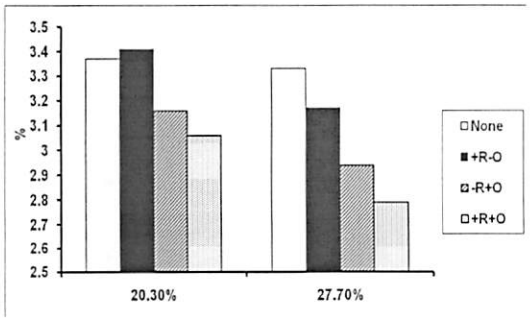


Grain x Monensin x Fat Interactions – Cow Study

- 80 Holsteins
- 2 x 2 x 2 factorial design
  - Two starch levels (27.7 and 20.3% of TMR)
  - 0 vs 13 ppm Rumensin
  - 0 vs 1.25% corn oil

Van Amburgh et al., 2008. Cornell Nutr. Conf.

Milk Fat %



Van Amburgh et al., 2008. Cornell Nutr. Conf.

Points to Remember

- CLA_{MFI} overproduction in the rumen leads to MFD.
- Feeding management controls MFD by limiting accumulation of CLA_{MFI} in the rumen.
- No single dietary factor is responsible for MFD.
  - interactions among various dietary components can increase the rumen outflow of CLA_{MFI}.
- All risks have to be considered with regard to the combination of factors at play in a given ration formulation and with regard to the limitations of management and physical plant.