DELTA INSTRUMENTS

A PerkinElmer Company

Wopke Beukema

Delta Instruments & Perten Instruments

Delta Instruments is a well-established manufacturer of rapid routine analytical instrumentation for the analysis of raw milk and its derivatives.

Perten Instruments is a leading supplier of analytical instruments for the food industry, offering a wide range of analytical methods for dairy products and processing.

Delta is now part of Perten and **together** we offer the widest range of analytical instruments for dairy analysis.

Introduction of new mid-FTIR

Herd Management Tools

for early warnings of nutritional and health issues in high producing dairy cows

By

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Herd Management tools available for: CombiScope FTIR 300/600 HP

- Chemical composition analysis and somatic cell count in raw milk (DHI – Payment samples)
- For cow Highest accuracy and repeatability at 300 and 600 samples per hour
- FDA approved, exceeds IDF and ISO guidelines.
- Low cost of ownership

CombiScope FTIR A600 HP

- CombiScope FTIR 600 HP with a fully automated sample handling system for warming, mixing, opening and closing of vials.
- Uncompromised analytical results of chemical composition and somatic cell count in 6 sec. per sample.
- Continuous and identical samples treatment
- Improve lab efficiency: one operator can handle 3 units.

DE NOVO FATTY ACIDS MODEL

The De Novo Models – Applications

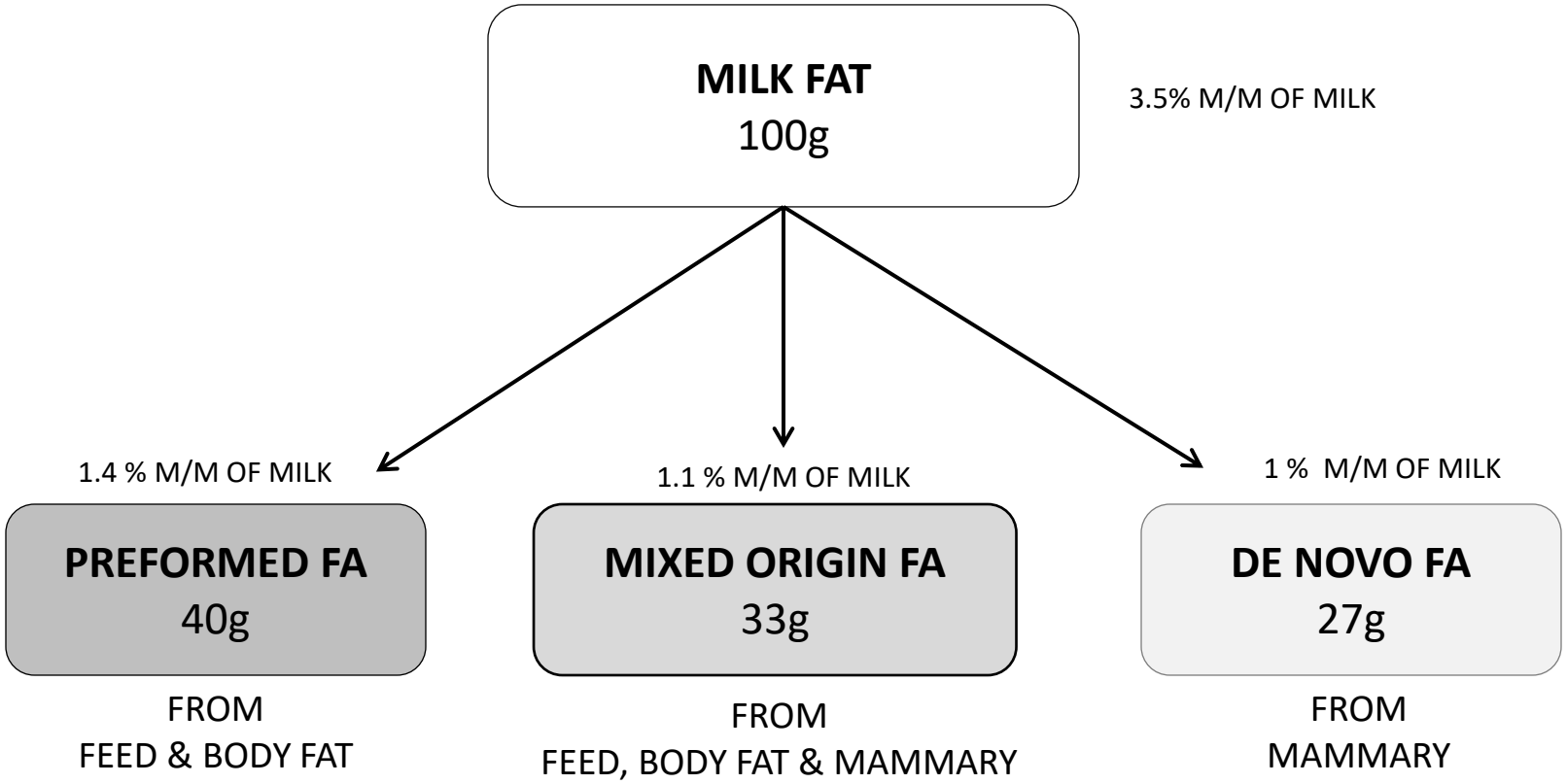
In bulk tank milk:

- To increase production, total fat and true protein output
- To prevent milk fat depression
- To improve feeding management strategies

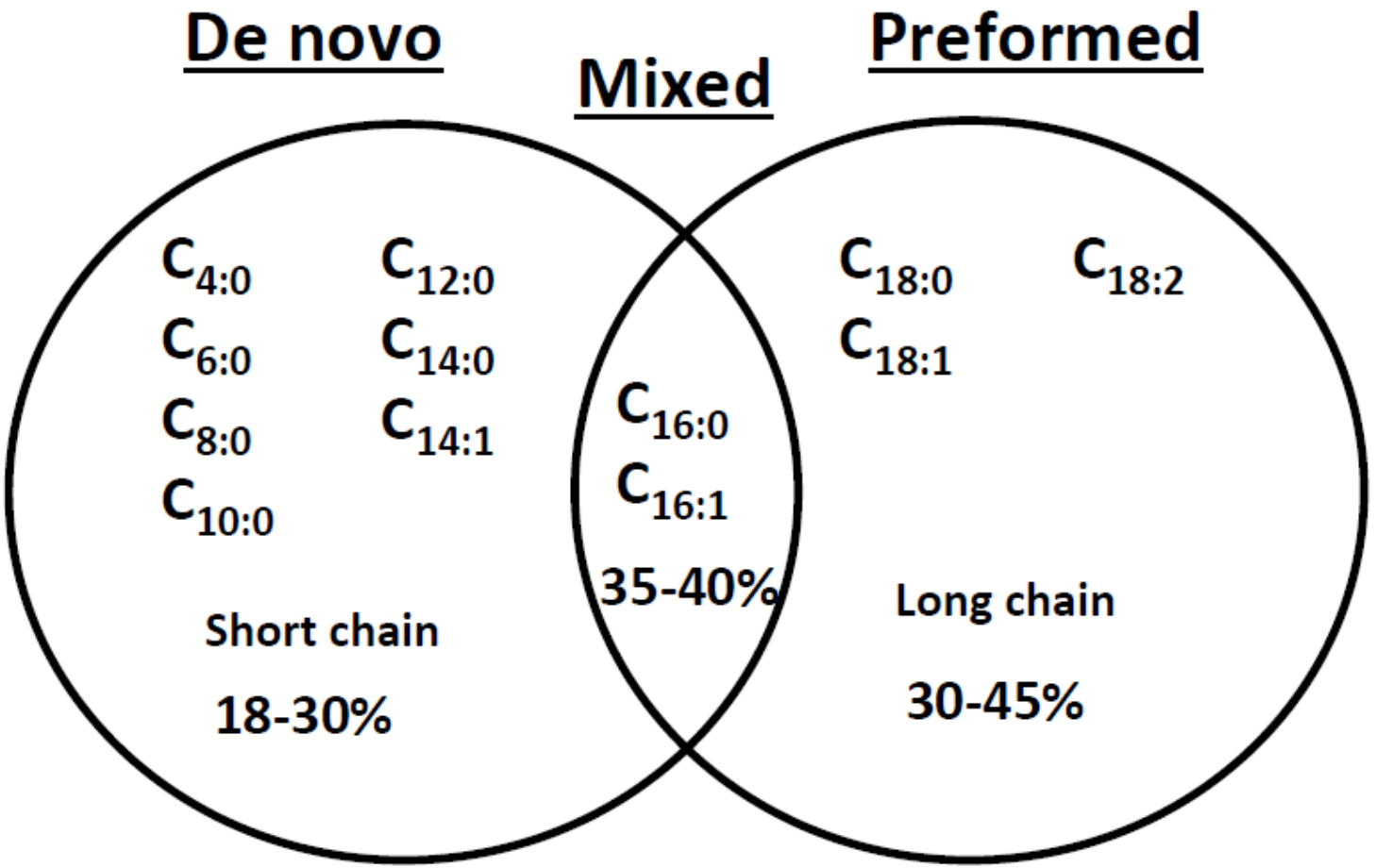
For individual fresh/early transition cow

- As early warning on displaced abomasum

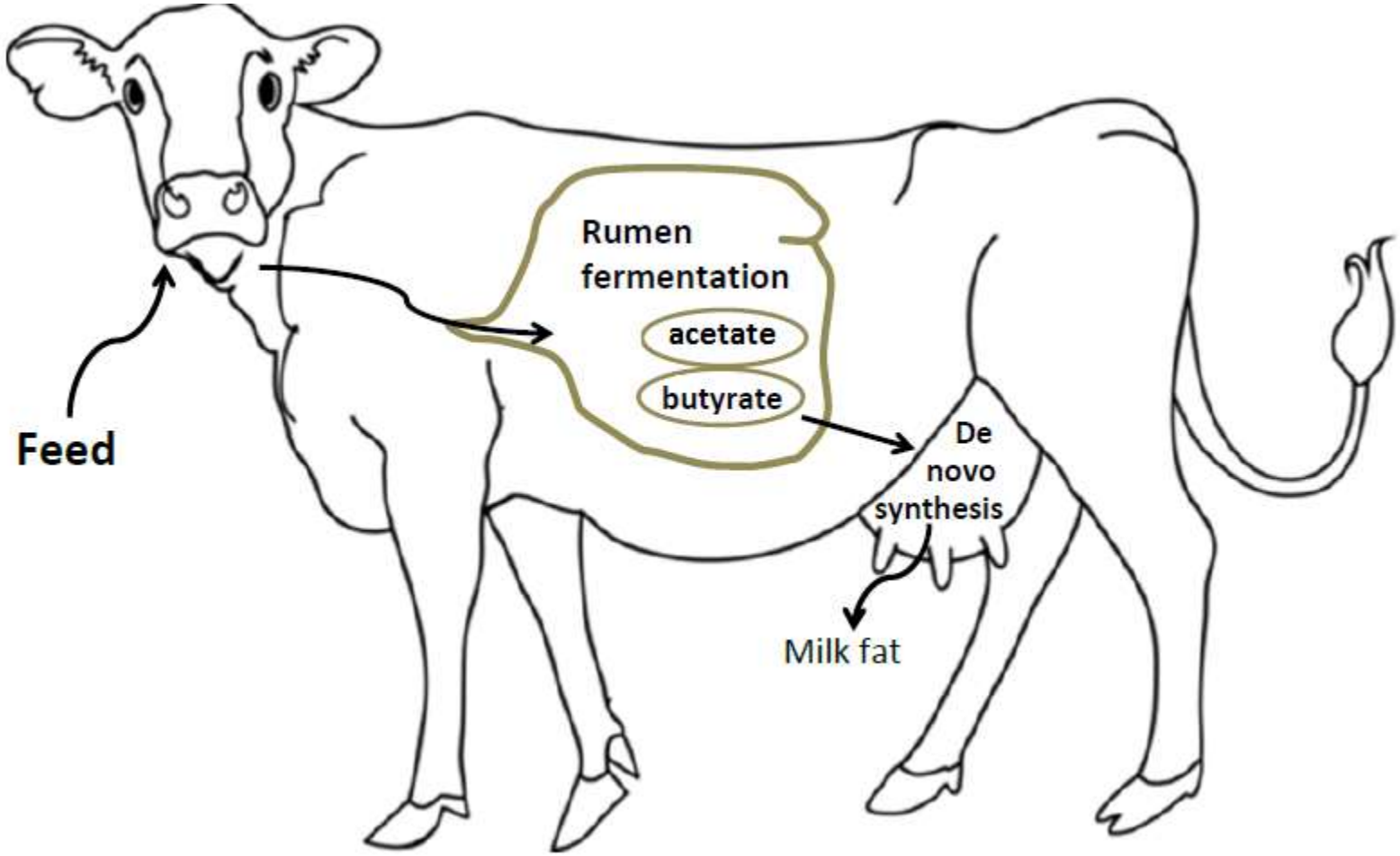
Typical Milk Fat Composition of a Dairy Cow



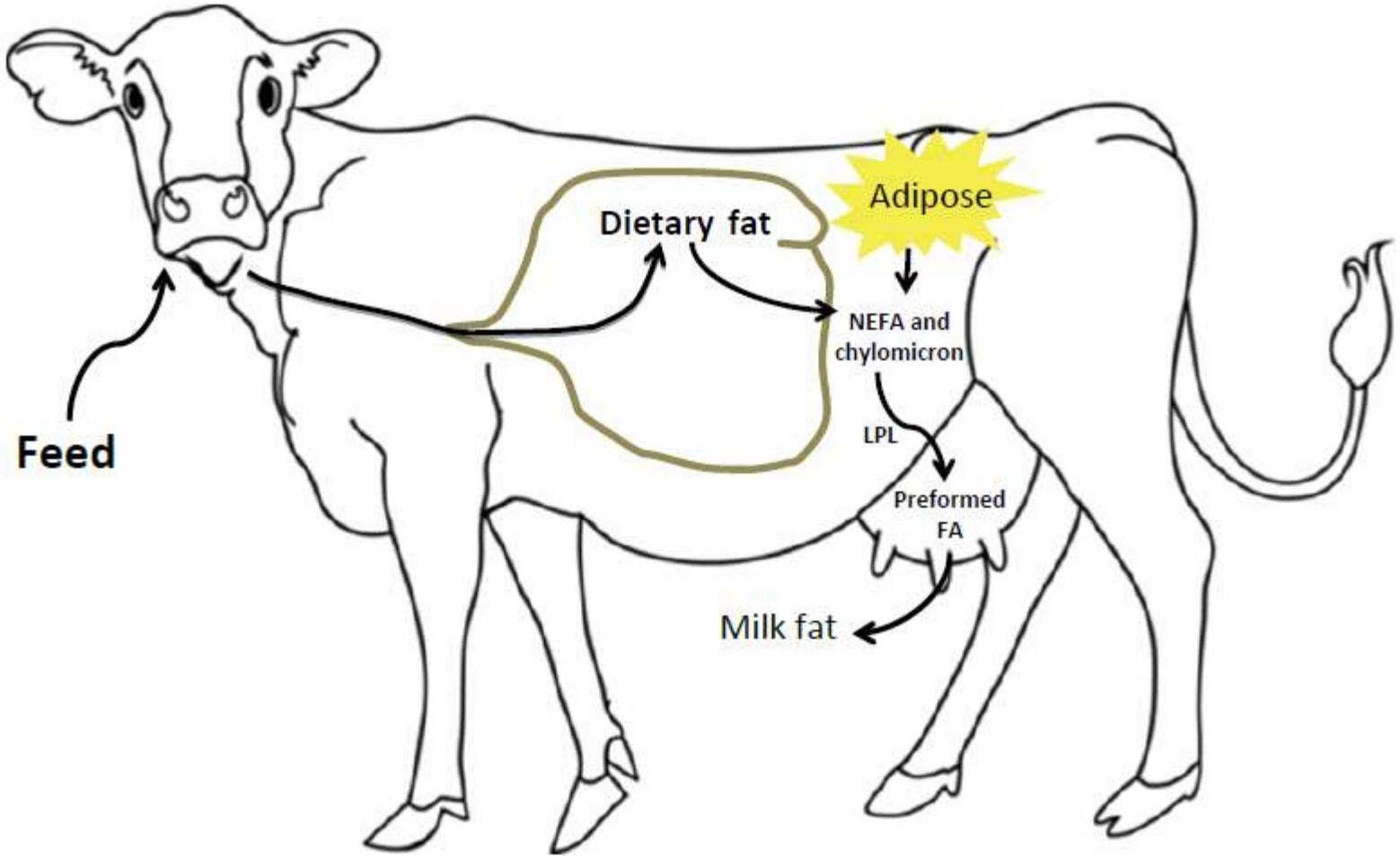
Typical Milk Fatty Acid Categories



De novo fatty acid synthesis

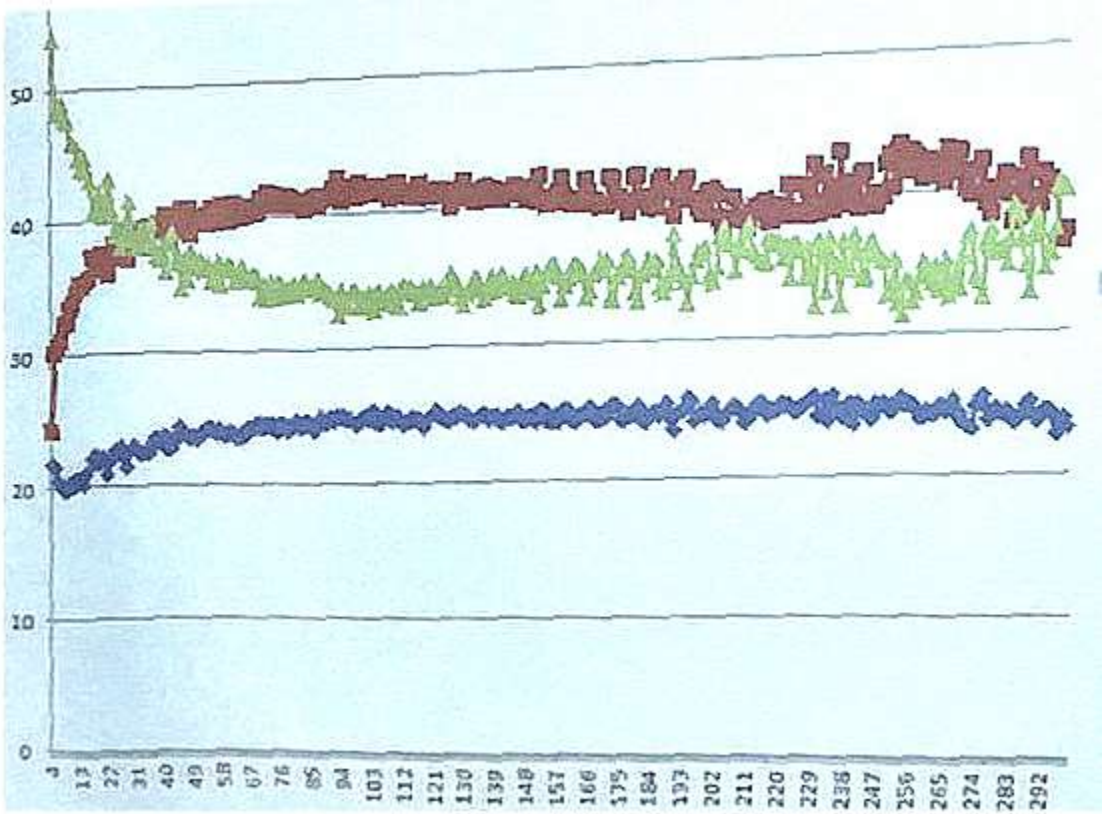


Preformed acid synthesis



De Novo Fatty Acids – Interpretation of Results

- **Fatty Acids changes over one full lactation period**
  Population: 250 Holstein cows



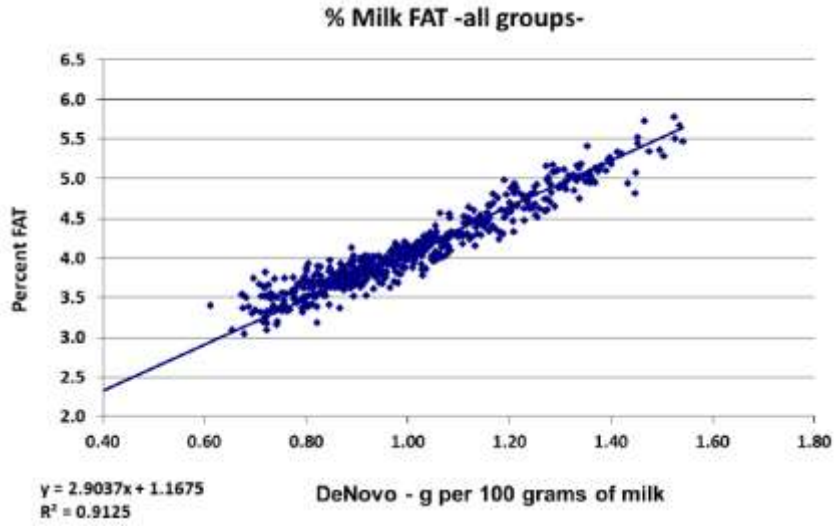
Average of relative mixed FA%

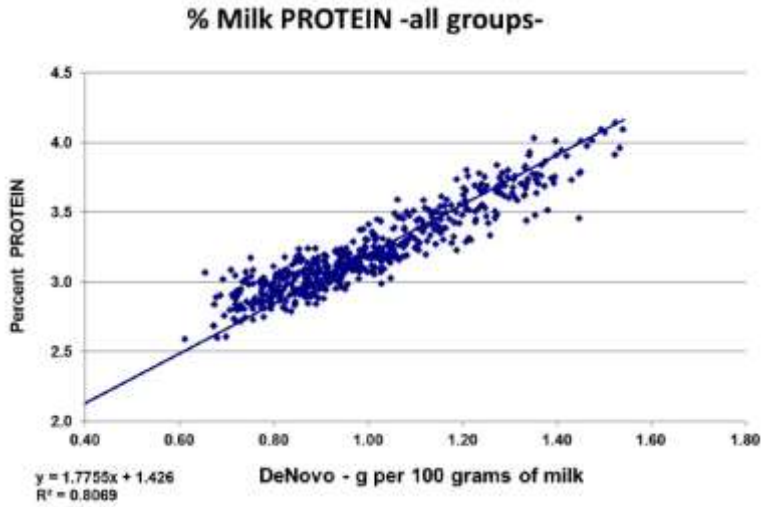
Average of relative preformed FA%

Average of relative de novo FA%

De Novo Fatty Acids - Model Background Information

- Models developed based on a collaboration study of 430 farm bulk tank milk and individual cow (St. Albans Cooperative, Cornell University, Miner Institute & Delta Instruments).
- The **breeds** involved in the study are pure **Holstein**, pure **Jersey** and Holstein-Jersey crossbreeds
- Main finding: There is a positive correlation between the De Novo FA to Total Fat, and De Novo FA to Total Protein.





Increasing De Novo FA will increase the production of Total Fat and Total Protein.

De Novo Fatty Acids – Model Description

Models performance

Parm.	Name	Range gr/100gr FA	Accuracy – herd typical Syx	Repeatability – herd typical Sr
9703	Absolute de novo	0.05-1.85	0.025	0.010
9704	Absolute mixed	0.05-2.05	0.045	0.015
9705	Absolute preformed	0.05-2.55	0.055	0.030

Sample characteristics:

- Breeds only by pure Holstein, pure Jersey, cross breeds Holstein-Jersey
- Unpreserved raw cow milk
- Preserved cow milk with Bronopol (0.1-0.2%), or Sodium Azide (0.03%)

De Novo Fatty Acids – Bulk Tank Milk

- **Purpose: monitor de novo to increase fat and protein**
- **Bulk tank milk sampling requirements:**
  - 130-150 DIM bulk tank milk*
  - Sampling frequency: by every delivery

- **Ideal normal bulk tank milk values in relative percentages**

	Pure Holstein	Pure Jersey
Total Fat	3.0%-4.4%	3.9-5.8%
De novo FA	24% – 27%	26.5-28.5%
Mixed FA	33-41%	35%-40%
Preformed FA	35-41%	30-41%

** DIM bulk tank milk calculated as the average DIM of each cow belonging to the herd*

De Novo Fatty Acids – Interpretation of Results

Bulk tank milk trigger level:
relative de novo FA< 24%

*Recommendations: First step is to improve **cow comfort** level so that:*

- Free stall density < 110%
- Bunk space per cow > 45 cm *(Wolpert et al. 2015).*
- Suitable bedding
- Optimal stall temperature

* **Stall density**: lying & resting spaces for cows – 100 spaces 110 cows = 110% density
* **Bunk space**: space between cows when feeding

De Novo Fatty Acids – Recommendations

Second step is to improve feeding management:

- Increase energy intake & forage quality: *(Wolpert et al. 2016)*
  - 2x day for free stalls
  - 5x for tie stalls.
- Adjust intake of fat and fatty acid composition in the diet
- Adjust intake of the rumen available starch
- Adjust the amount of physically effective fiber:
  - Recommended increase of neutral detergent fiber NDF>35% DM
  - Recommended rise physically effective non-degradable fiber peNDF> 21% DM
- Adjust particle size of the fiber: Recommended: ½ of the forage with a particle length of at least 2.6 cm to stimulate chewing.

De Novo Fatty Acids – Individual cows

DA trigger levels for individual fresh/transition cow

relative de novo FA< 18%

decreasing from day 4 to day 12 DIM

De novo FA levels gives early warnings about risks of a **displace abomasum** within 3-4 days of the onset condition.

Milk based Blood NEFA model

Blood NEFA values are a snapshot of the NEFA concentration at that instant in time.

The milk based predicted blood NEFA represents a time average for the total time between milkings.

Uses of the model:

- To provide information about the severity of the negative energy balance status of an individual fresh/transition cow
- To provide early warnings on metabolic diseases
  - Clinical ketosis
  - Subclinical ketosis
- By NEFA values below 200 µEq/l the model is not usable/interesting

Blood NEFA Predicted Values In Milk Model - Description

Models performance:

Parm.	Name	Range µEq/l	Accuracy – cow – specified Syx	Repeatability – typical Sr	Repeatability – specified Sr
1603	NEFA (Blood)	200-1860	172	30	60

Sample characteristics:

- Breeds only by pure Holstein, pure Jersey, cross breeds Holstein-Jersey
- Unpreserved raw cow milk
- Preserved cow milk with Bronopol (0.1-0.2%), or Sodium Azide (0.03%)

Blood NEFA Predicted Values In Milk Model

- **Sampling characteristics:**
  - Individual cow milk of a fresh/transition cow within 14-60 DIM
  - Advised sampling frequency: weekly (DHIA system: every 4-6 weeks)

14-60 DIM: trigger levels for individual transition cow:

Subclinical ketosis: 600 mEq/l < Blood NEFA values < 800 mEq/l

Clinical ketosis: Blood NEFA values > 800 mEq/l.

Blood NEFA Predicted Values In Milk Model - **Recommendations**

Acceptable level for 14-60 DIM:

NEFA < 600 mg/l

Subclinical Ketosis 14-60 DIM:

600 < NEFA < 800 mg/l => Increase energy intake

Clinical Ketosis 14-60 DIM:

NEFA > 800 mg/l => glycol injection required

Herd Management Tools available:

Date: **November 2016**

Operational in

CombiScope FTIR 300 HP
CombiScope FTIR 600 HP
CombiScope FTIR A600 HP

HERD MANAGEMENT TOOLS