

**VARIATION IN MILK PROTEINS
ACROSS A CONTEMPORARY
GROUP OF HOLSTEIN CATTLE**

TP Cattle Services, LLC
Drs. Tom Smith & Erika Huyck
With special thanks to Serenity Tyll,
summer intern

TP Cattle Services, LLC
Drs. Tom Smith & Erika Huyck
With special thanks to Serenity Tyll,
summer intern

SARE Grant

- **Nationwide mission: SARE's wider mission is to advance, to the whole of American agriculture, innovations that improve profitability, stewardship, and quality of life by investing in groundbreaking research and education.**

Partnership Grants

Partnership Grants are reserved for agricultural service providers, extension staff, innovators, consultants, state departments of agriculture, and others working in the agricultural community who want to create a platform for demonstration, research, marketing, and other projects with farmers or active cooperators. The Partnership guidelines have been expanded to incorporate proposals that used to be submitted under the Sustainable Community Grant.

Study design

- Three post milking samples taken from 1,200 mid lactation cows at Sunnyside farms in Scipio, NY.
- Samples pooled and chemically fractionated to determine variability between cows and the potential for heritability.

Industrial significance

1. Current selection criteria – Total Protein
 - ▣ Lumps all milk proteins together
 - ▣ Genetic progress cancelled out – Little actual progress made.
 - ▣ Area of opportunity to improve selection criteria.
2. Milk processing
 - ▣ Besides breed differences and management differences there is no directed processing occurring despite the potential for more efficient practice.
 - ▣ IE the farms that excel in casein production go to the cheese plant whereas the farms that excel in producing whey proteins go to the milk powder plants.

What are the known Milk Proteins

▣ Caseins (alpha S1, alpha S2, beta, kappa, gamma folding configurations)	▣ 78.8%
▣ Alpha lactalbumin	▣ 9.8%
▣ Beta lactoglobulin	▣ 1.2%
▣ Bovine serum albumin	▣ 2.4%
▣ Immunoglobulin	

Individual Protein Uses

- ▣ Caseins
 - ▣ "Casein-rich" products: Creams, yogurt, butter
 - ▣ Protein powders and bars
 - ▣ Most allergenic milk protein
- ▣ Alpha lactalbumin
 - ▣ Medical nutrition
 - ▣ Rate limiting amino acids for antioxidant production
 - ▣ Medical formulations for the treatment of diabetes
 - ▣ Health foods
 - ▣ Muscle health & sarcopenia prevention
 - ▣ Affects naturally occurring serotonin & melatonin levels
 - ▣ Infant formulas
 - ▣ Comprises a higher proportion of the protein in human breast milk so alpha lactalbumin rich cows milk is a better alternative for infant formula
 - ▣ Infants fed alpha lactalbumin rich milk have growth curve patterns more similar to breast fed babies
 - ▣ Supplements can also reduce and prevent diarrhea in babies
 - ▣ Sports nutrition
 - ▣ Reduces oxidative stress
- ▣ Beta lactoglobulin
 - ▣ Functions unknown, believed to act as a transport vehicle for other macromolecules

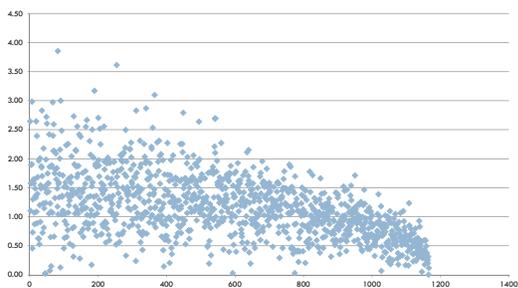
Purification Process

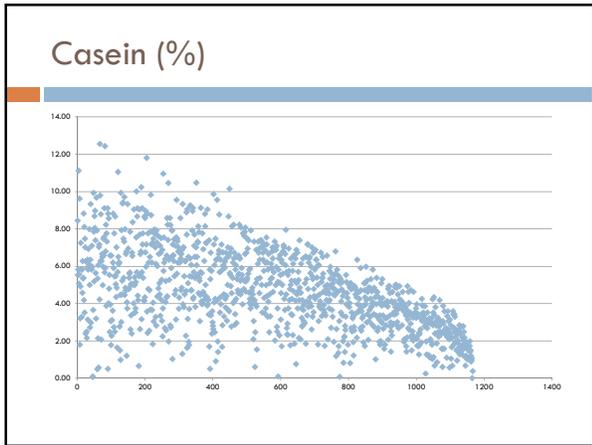
- Step one: Production of skim milk through centrifugation and removal of fat.
- Step two: Separation of casein and whey. The fat layer was removed and the remaining skim milk was heated. 10% acetic acid was used to acidify the sample and separate the casein. The whey was retained for further fractionation.
- Step three: Isolation of alpha-lactalbumin. A method of isolating - lactalbumin from whey, comprising the steps of: acidifying whey; heat treating acidified whey; adding an organic solvent to heat-treated whey wherein solvent extracts -lactalbumin and leaves solvent-insoluble whey components; separating solvent-insoluble whey components from organic solvent; and thereafter precipitating - lactalbumin by adding a base to solvent extract; separating - lactalbumin precipitate from organic solvent; and thereafter drying -lactalbumin precipitate.
- Step four: Isolation of beta lactoglobulin. B-lactoglobulin was isolated utilizing chitosan as a coagulant under basic conditions.

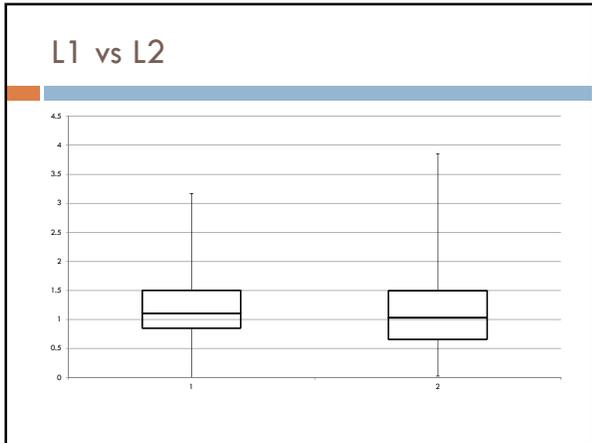
Data Collected/Analyzed

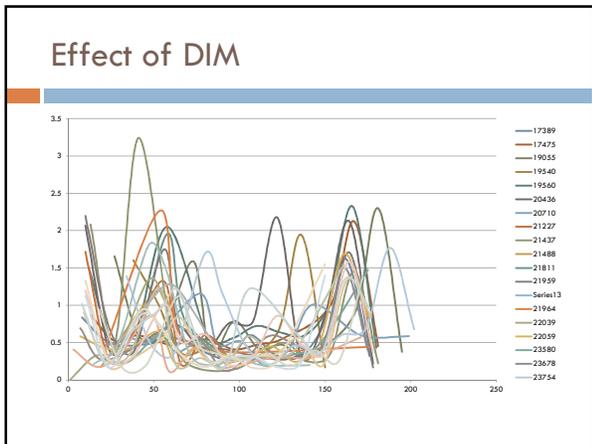
- Protein fractions by weight and percent
 - ▣ Casein
 - ▣ Whey
 - Alpha lactalbumin
 - Beta lactoglobulin
- Effect of Lactation
- Effect of Stage of Lactation (DIM)

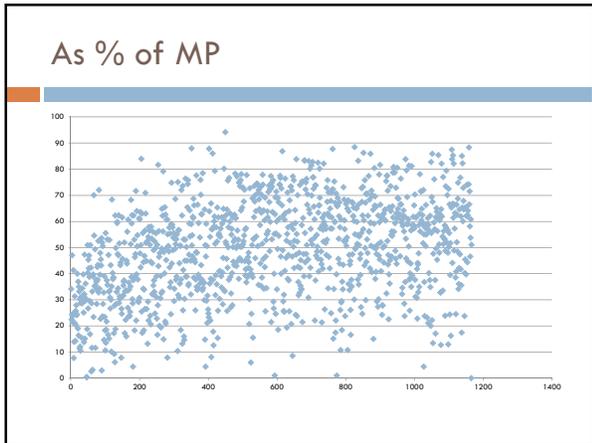
Casein (lbs)

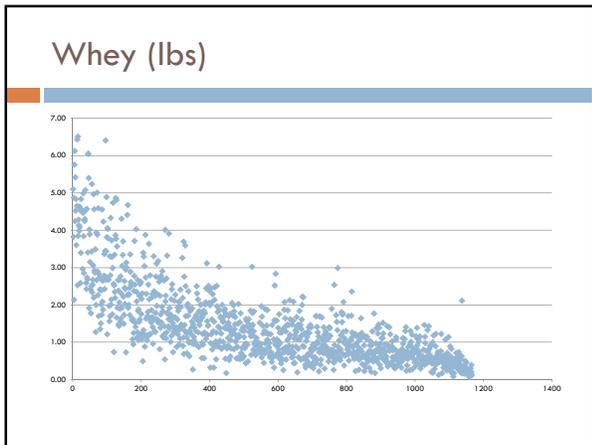


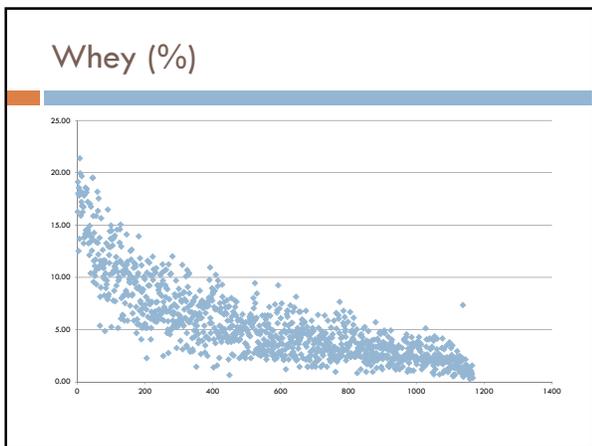


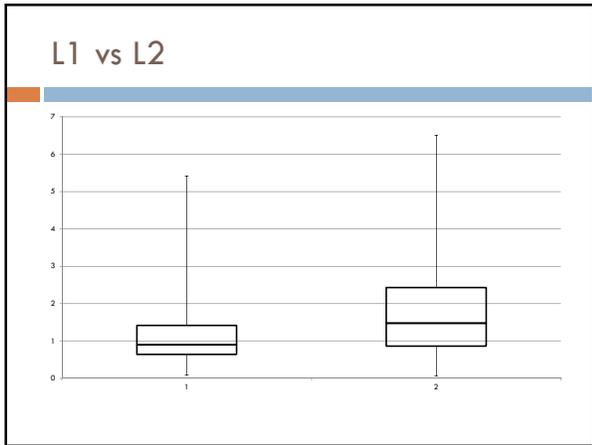


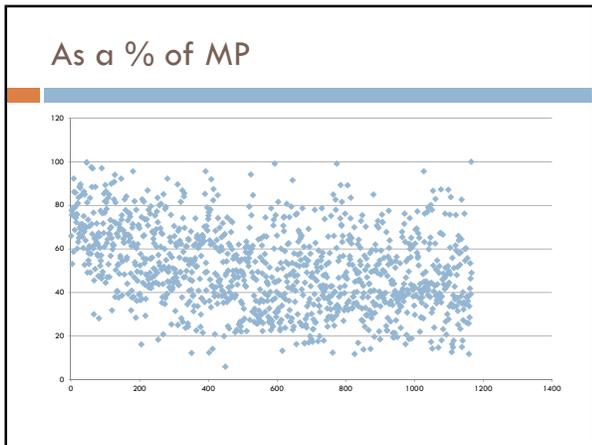


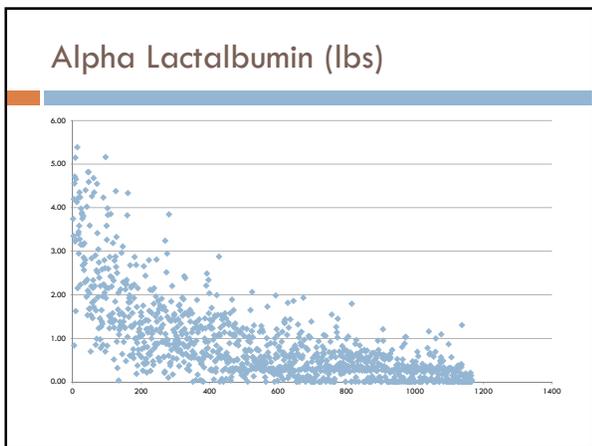


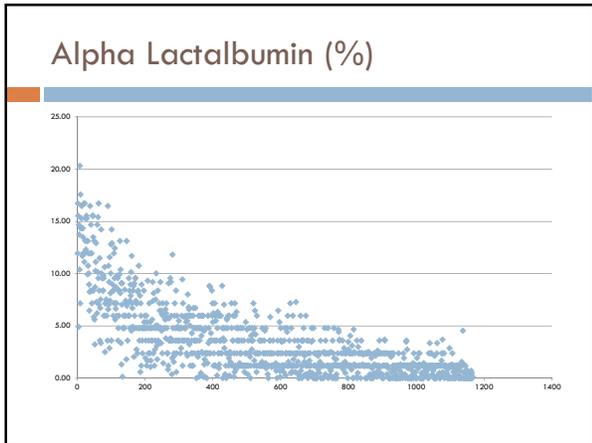


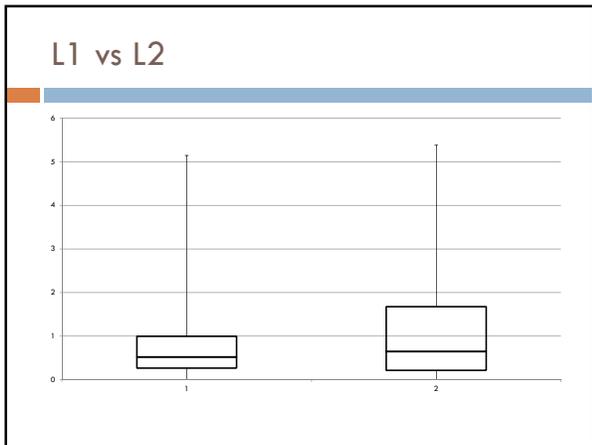


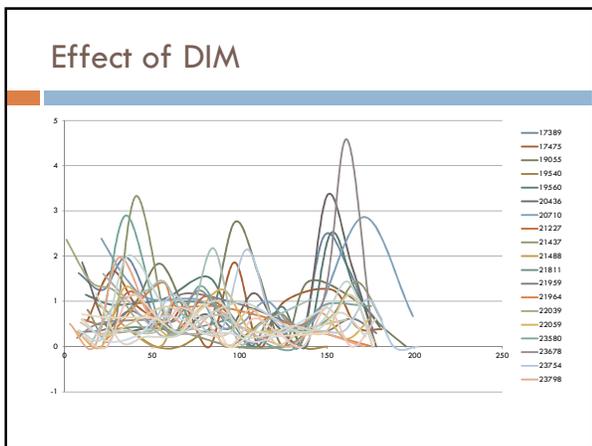


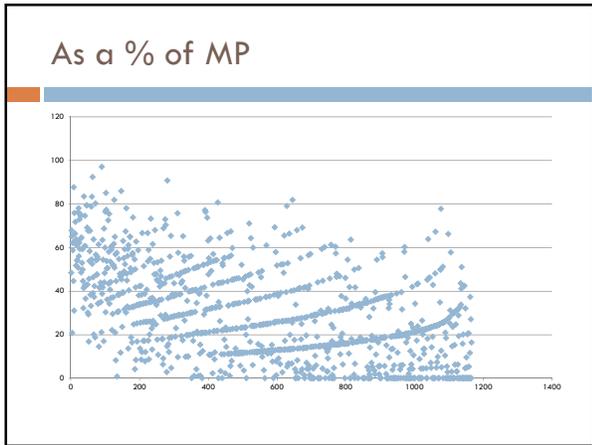


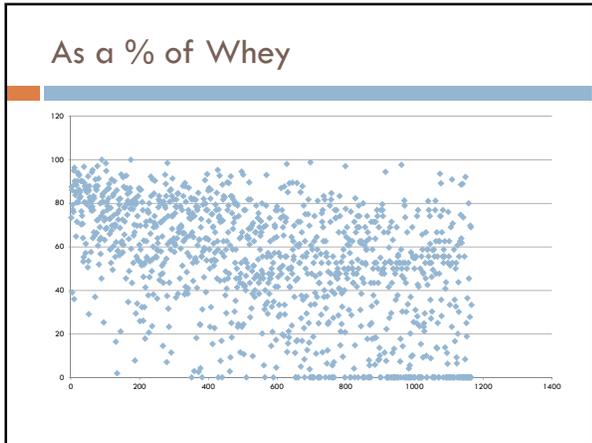


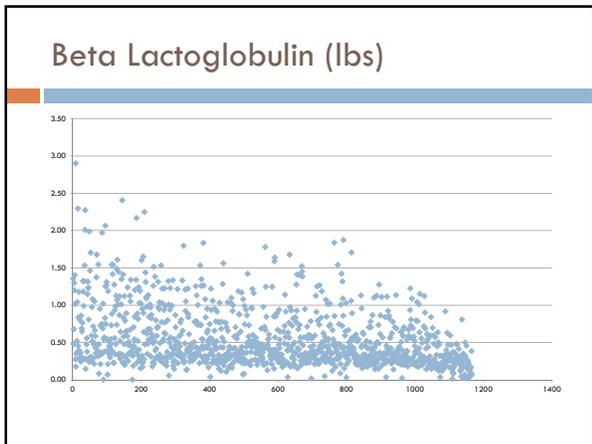


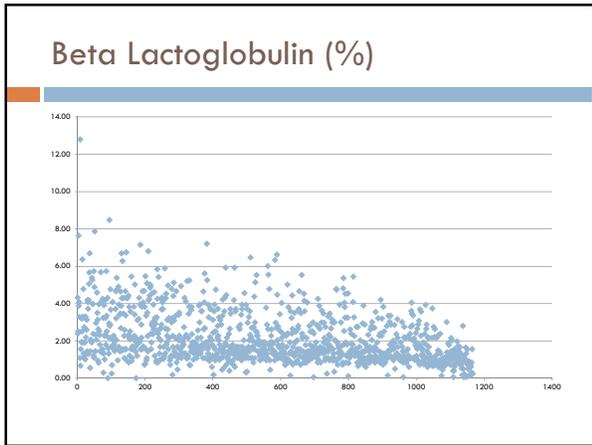


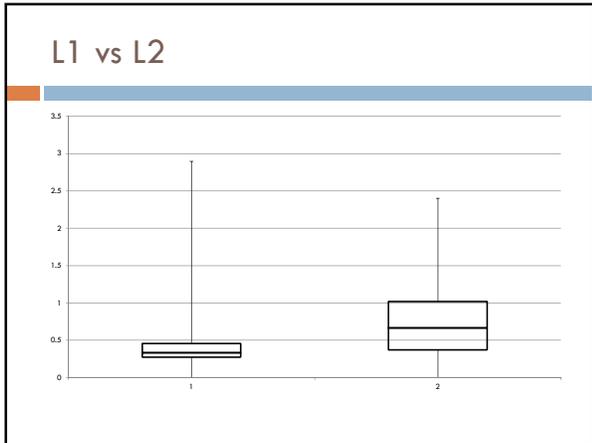


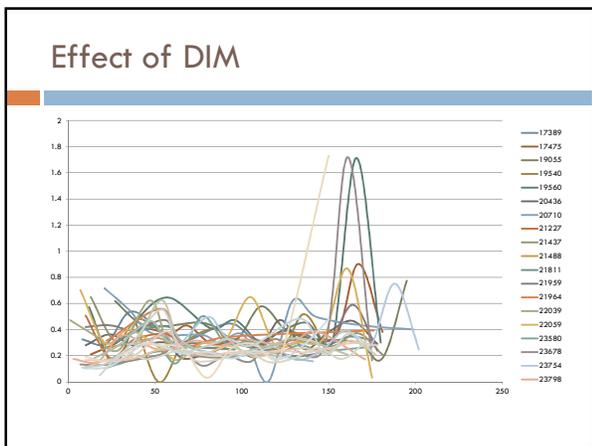


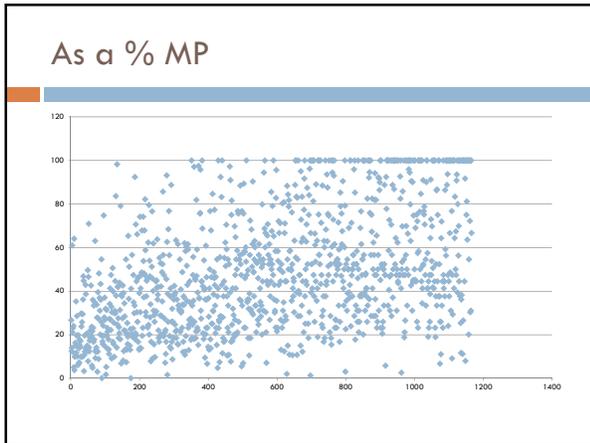


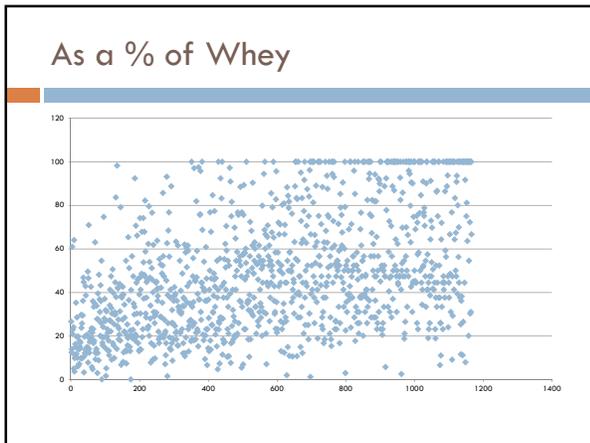












Conclusions

- High Variability Exists within this Contemporary Group for ALL MILK PROTEINS
- DIM does not seem to have a large effect on milk protein concentrations when compared to other variables
- Differences Exist within Lactation Groups, especially for whey although it is not clear how much of this is due to genetics vs maturity

Conclusions cont'd

- There is variance within both lbs of protein and percent protein with a correlation which would closely mimic that for overall MP (65-70%)
- There are flaws in the existing "Gold Standard Procedure" for milk protein evaluation which would favor a new procedure being developed
- Milk proteins are much more complex than traditionally believed but will be a huge area of opportunity for the future of the dairy industry

Future Projects and Opportunities

- Farm and plant level sampling and testing
- Genetic selection criteria developed
- Develop a cow-side/plant entry screening test
- Feeding and management trials to maximize each protein fraction
- Streamlined milk processing to reduce waste and improve profitability and efficiency.
- New milk markets and products explored for human health benefits

Questions?



Open Discussion Forum
