Human Milk Macronutrient Loss Differs Between Enteral Tube Feeding Systems

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Objective

To compare breastmilk macronutrient losses after delivery through syringe and feeding bag enteral feeding systems.

Background

Requirement of Enteral Feeding:
- Immature feeding reflexes results in required prolonged periods of enteral tube feeding
- Many premature infants are intolerant of bolus feeding

Importance of Fat Content:
- Prior research has shown losses in macronutrients, especially fat, with enteral tube feeding systems
- Fat is critical to the needed rapid brain and lung development
- Fat provides 50% of calories in breastmilk, enteral tube feeding can lead to up to 16% loss of daily calories

Importance of Weight Gain:
- Weight gain during NICU stay closely linked to neurodevelopmental outcomes at 18 months

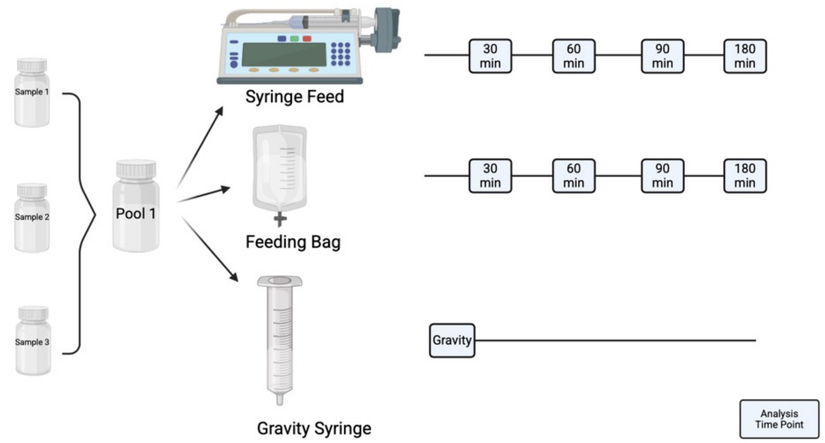
Benefits of Breastmilk:
- Breastmilk compared to formula leads to reduced rates of retinopathy of prematurity (ROP), necrotizing enterocolitis (NEC), and chronic lung disease

Prolongation of enteral feeding times results in significant losses in fat and energy content of breast milk.

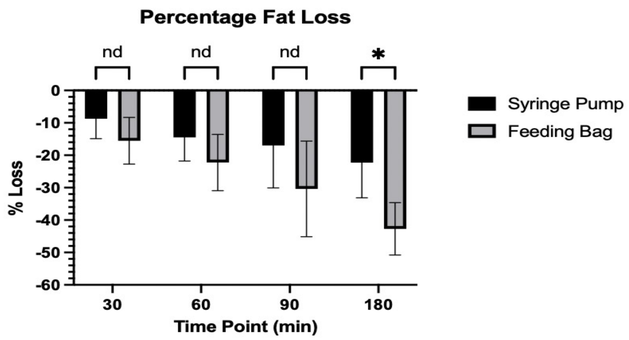
Losses are greater with feeding bag systems than syringe pump systems.

Methodology

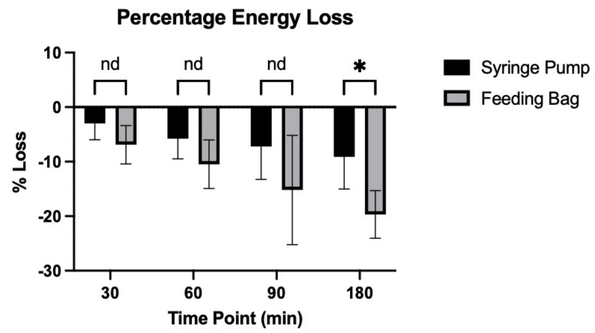
- **Sample Preparation**: Frozen de-identified pasteurized and unpasteurized human milk combined into 10 discrete pools for analysis
- **Enteral Tube Feeding Set-up:** Moog feeding bags and NeoMed 35 ml syringes were connected to extension tubing and a 5 French feeding tube for simulations
- **Tube Feeding Simulations:** For each simulation, 20 ml of milk was delivered over 30, 60, 90, or 180 minutes (continuous feeds). This was repeated for each pool of milk
- **Sample Analysis:** Baseline and post-delivery macronutrient composition was analyzed using a mid-infrared milk analyzer (Miris, Uppsala, Sweden).
- **Statistical Considerations:** Statistical analyses were performed using repeated measures ANOVA or Mann-Whitney tests.



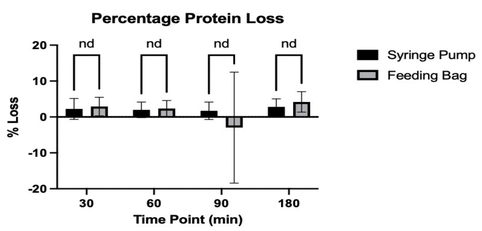
Results

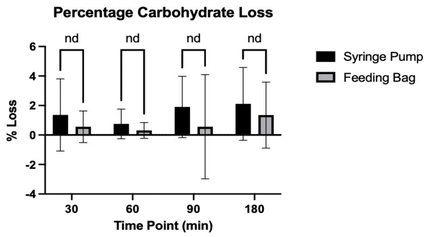


A significant reduction in fat content with prolonged feeding time ($p<0.0001$) and use of a feeding bag was observed ($p=0.0013$). With direct comparison of syringe pump to feeding bag, a significant difference in fat loss was demonstrated at 180 minutes ($p=0.003$).



Syringe pumps demonstrated a 9% loss and feeding bag systems demonstrated an average of 20% loss in energy content (kcal) at 180 minutes ($p-=0.003$).





Future Directions

- Comparison of Macronutrient Loss of Previously Frozen Maternal Milk vs. Pasteurized Donor Milk
- Exploration of Novel Cost-Effective Interventions to Minimize Macronutrient Loss of Breastmilk Delivered through Enteral Tube Feeding Systems
  - Tube Priming with MCT Oil
  - Continuous Warming of Delivered Breastmilk