Histidine dose-response effects on lactational performance and plasma amino acid concentrations in lactating dairy cows fed a metabolizable protein deficient diet

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Take-home message:
Histidine supplementation on a MP-deficient diet increased milk yield and milk protein yield linearly in mid-lactation cows.
High producing cow → high protein diet → excess nitrogen in urine → economic and environmental burden
Histidine can become a limiting AA for milk and milk protein production with metabolizable protein (MP)-deficient diets.

- *Less Dietary RUP**
- **More Reliance on Microbial Protein**
- **Less His Absorbed**
- **Less His Available for MG**

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*Metabolizable Protein = Protein absorbed as amino acids at small intestine

**Rumen Undegradable Protein
Hypothesis:

MP-deficient diet amplifies the effects of His deficiency

• His deficiency decreases
  ➢ Dry matter intake, milk yield and milk component yields
  ➢ plasma His concentrations

• Increasing levels of His increase these variables linearly

Objective:

To assess the effect of increasing His dose on lactational performance and plasma His concentration of lactating cows fed a MP-deficient diet
Design

Days in milk: 64 ± 12
Milk yield: 43.5 ± 7.8
12 Multiparous
8 Primiparous

Replicated 4×4 Latin square
28-d periods
Sampling on wk 4
Treatments

1. BASAL DIET
   1.76% d+His
   39.6 g/d

2. BASAL DIET
   + 62 g/d RPh15
   2.41% d+His
   53.8 g/d

3. BASAL DIET
   + 102 g/d RPh15
   2.82% d+His
   61.8 g/d

4. BASAL DIET
   + 142 g/d RPh15
   3.25% d+His
   72.5 g/d
Data Collections

Dry matter intake

Milk yield & milk components

Plasma for AA
All data were analyzed using PROC MIXED of SAS with treatment and period in the model.

Square and cow within square were random effects.

Contrasts:
- Linear and quadratic effects of His inclusion rate
- Significance was declared at $P \leq 0.05$
Results – Dry matter intake

20 kg/d

Treatment: N.S
Results – Milk Yield

MY, kg/d

Treatment

dHis1.8

dHis2.4

dHis2.8

dHis3.3

P = 0.01
Results – milk protein yield

Component yield, kg/d

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Component yield, kg/d</th>
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<tbody>
<tr>
<td>dHis1.8</td>
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<td>dHis2.4</td>
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P < 0.001
Results – Plasma histidine

His Concentration, µM

- dHis1.8
- dHis2.4
- dHis2.8
- dHis3.3

Treatments

P < 0.001
Conclusions and future considerations

LACTATIONAL PERFORMANCE WAS OPTIMIZED AT 3.3% DHI'S OF MP OR 73 g/d.

HOW DOES MP-LEVEL AFFECT HISTIDINE REQUIREMENTS?

WHAT ARE THE LONG-TERM EFFECTS OF HIS-DEFICIENCY?
Thank you

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