L-Threonine and L-Tryptophan Inclusion in Milk Replacer Diets

Objective

To determine the effect of L-Threonine (THR) and L-Tryptophan (TRP) supplementation in milk replacers fortified with potato or modified wheat protein on the growth of veal calves.

Experimental Procedures

One hundred two (102) male Holstein calves (7 weeks of age) were placed on one of six experimental treatments until 18 weeks of age. The treatments consisted of the calves being fed one of the three milk replacer diets or the calves being fed one of the three milk replacer diets supplemented with THR and TRP (Table 1). The calculated nutrient specifications of the finisher diets are in Table 2.

Table 1. Feed composition - finisher feed

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>$/CWT</th>
<th>Control (c)</th>
<th>Potato (P)</th>
<th>Potato/Wheat (P/W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dry Fat 7/60</td>
<td>45.00</td>
<td>540</td>
<td>551</td>
<td>564</td>
</tr>
<tr>
<td>Lecithin</td>
<td>70.00</td>
<td>18</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>Whey Protein Concentrate</td>
<td>62.50</td>
<td>491</td>
<td>318</td>
<td>129</td>
</tr>
<tr>
<td>Potato Protein</td>
<td>80.00</td>
<td>68</td>
<td>68</td>
<td>68</td>
</tr>
<tr>
<td>Modified Wheat Gluten</td>
<td>80.00</td>
<td></td>
<td>65</td>
<td></td>
</tr>
<tr>
<td>Whey</td>
<td>22.50</td>
<td>892</td>
<td>986</td>
<td>1090</td>
</tr>
<tr>
<td>Premixa</td>
<td>90.00</td>
<td>50</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Dicalcium Phosphate</td>
<td>30.00</td>
<td>3.4</td>
<td>2.4</td>
<td>3.3</td>
</tr>
<tr>
<td>Calcium Carbonate</td>
<td>6.00</td>
<td>3.4</td>
<td>6.3</td>
<td>8.3</td>
</tr>
<tr>
<td>L-Lysine HCl</td>
<td>115.00</td>
<td>1.5</td>
<td>0.4</td>
<td>3.3</td>
</tr>
<tr>
<td>DL-Methionine</td>
<td>150.00</td>
<td>0.8</td>
<td>0.2</td>
<td></td>
</tr>
<tr>
<td>$/ton of Feed</td>
<td>812.32</td>
<td>782.41</td>
<td>748.96</td>
<td></td>
</tr>
</tbody>
</table>

*aPremix supplied an additional 3.8 lbs L-Lysine HCl, 1.0 lbs DL-Methionine, 12.5 lbs Dical, and 1.25 lbs Calcium Carbonate per ton of feed*

Table 2. Calculated nutrient values of finisher feeds

<table>
<thead>
<tr>
<th></th>
<th>C</th>
<th>P</th>
<th>C'</th>
<th>P'</th>
<th>P/W'</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Tot</td>
<td>Dig</td>
<td>Tot</td>
<td>Dig</td>
<td>Tot</td>
</tr>
<tr>
<td>LYS (%)</td>
<td>1.30</td>
<td>1.33</td>
<td>1.25</td>
<td>1.30</td>
<td>1.25</td>
</tr>
<tr>
<td>M+C (%)</td>
<td>0.62</td>
<td>0.64</td>
<td>0.60</td>
<td>0.65</td>
<td>0.60</td>
</tr>
<tr>
<td>THR (%)</td>
<td>0.90</td>
<td>0.85</td>
<td>0.91</td>
<td>0.83</td>
<td>0.77</td>
</tr>
<tr>
<td>TRP (%)</td>
<td>0.22</td>
<td>0.21</td>
<td>0.22</td>
<td>0.21</td>
<td>0.19</td>
</tr>
</tbody>
</table>

aMcal/kg
Before receiving the finisher diets, each calf received 100 lbs of a grower diet. The grower diets were approximately 18% crude protein and of the same composition as the finisher diets. Calves on THR and TRP supplementation (C+, P+ and P/W+) received supplementation during the entire experimental period (Grower and Finisher).

Fifteen percent of the protein of the whey based control (C) was replaced by potato protein in diet P. In the Potato/Wheat (P/W) diet, 15% of the protein of (C) was replaced by potato protein and 15% of the protein was replaced by modified wheat protein. Supplementation increased digestible threonine and tryptophan intake by approximately 10% and 5%, respectively, relative to the basal diets. Dry matter milk replacer intake was between 1.5-2.0% of body weight.

Table 3. Digestible THR and TRP intake during experimental period

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Potato</th>
<th>Potato/Wheat</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>THR</td>
<td>TRP</td>
<td>THR</td>
</tr>
<tr>
<td>Finisher Feed Composition %</td>
<td>0.85</td>
<td>0.21</td>
<td>0.85</td>
</tr>
<tr>
<td>Grams fed during exp. period</td>
<td>1794</td>
<td>434</td>
<td>1848</td>
</tr>
<tr>
<td>Grams Supplemented</td>
<td>162</td>
<td>27</td>
<td>162</td>
</tr>
<tr>
<td>Total Fed (grams/calf)</td>
<td>1956</td>
<td>481</td>
<td>2010</td>
</tr>
</tbody>
</table>

Results

The weight and weight gains for the different diets are given in (Table 4). No significant differences in live weight or weight gain were observed among the different experimental diets, although the calves with the highest level of plant proteins gained slightly less during the whole period. THR and TRP supplementation improved growth during the supplementation period (week 7 to 18) by 6.1 pounds on the P/W and 7.5 pounds on the P diet (See Figure 1).

Table 4. Table of results

<table>
<thead>
<tr>
<th>Week</th>
<th>C</th>
<th>P</th>
<th>P/W</th>
<th>C+</th>
<th>P+</th>
<th>P/W+</th>
<th>S(^a)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (lbs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>95.7</td>
<td>184.8</td>
<td>422.2</td>
<td>94.4</td>
<td>187.1</td>
<td>422.9</td>
<td>98.9</td>
</tr>
<tr>
<td>7</td>
<td>184.8</td>
<td>422.9</td>
<td>98.9</td>
<td>184.5</td>
<td>418.5</td>
<td>423.8</td>
<td>181.5</td>
</tr>
<tr>
<td>18</td>
<td>422.2</td>
<td>418.5</td>
<td>181.5</td>
<td>416.1</td>
<td>423.8</td>
<td>423.0</td>
<td>180.6</td>
</tr>
<tr>
<td>Weight Gain (lbs)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-7</td>
<td>87.6</td>
<td>89.4</td>
<td>84.7</td>
<td>84.7</td>
<td>83.6</td>
<td>22.5</td>
<td></td>
</tr>
<tr>
<td>0-18</td>
<td>325.4</td>
<td>325.9</td>
<td>316.0</td>
<td>321.7</td>
<td>331.8</td>
<td>20.2</td>
<td></td>
</tr>
<tr>
<td>7-18</td>
<td>237.4</td>
<td>235.7</td>
<td>234.0</td>
<td>234.6</td>
<td>234.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dressed Weight and Dressing %</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DW</td>
<td>244.1</td>
<td>243.1</td>
<td>240.5</td>
<td>239.6</td>
<td>243.1</td>
<td>241.3</td>
<td></td>
</tr>
<tr>
<td>%</td>
<td>58.3</td>
<td>57.5</td>
<td>57.5</td>
<td>57.9</td>
<td>57.4</td>
<td>57.1</td>
<td></td>
</tr>
</tbody>
</table>

\(^a\)Standard Error
**Conclusion**

Whey protein concentrate can be replaced by potato protein or by a potato protein-modified wheat combination in milk replacers as long as L-THR and L-TRP are supplemented. These diets are shown to give equivalent performance with substantial cost savings when compared to a whey based control diet. Digestible threonine and tryptophan requirements are at least 0.85% and 0.22%, respectively.

**Bibliography**

This research was conducted in the summer of 1995 at the Animix Research Farm in Juneau, WI. Data on file at Ajinomoto Heartland, Inc., Chicago, IL.