Determination of the second limiting amino acid for Japanese quails in the period of 1-21 days

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Abstract: To evaluate the second limiting amino acid for Japanese quails of 1 to 21 days of age, an experiment was conducted in a completely randomized block design with eight treatments and eight replications of 15 birds each, totaling 480 animals. The average initial weight (8.23 ± 0.16 g) was balanced among all plots. Each treatment contained supplementation of DL-methionine plus an essential amino acid. T1: (DL-Met); T2: (T1+Lys); T3: (T1+Thr); T4: (T1+Trp); T5: (T1+Val); T6: (T1+Arg); T7: (T1+Ile and T8: (T1+All). The parameters evaluated were feed intake (FI), weight gain (WG) and feed conversion (FC). There was no significant difference ($P = 0.4350$) between the treatments for feed intake. Weight gain and feed conversion were affected ($P = 0.0001$) by supplementation. Treatment 2 (Met+Lys) provided higher WG and better FC, followed by T1 (Met). Supplementation of valine, arginine and isoleucine had the same effect on weight gain and feed conversion, which was also true for the treatments containing supplemental threonine (T3) or supplementation of all amino acids (T8: Met+Lys+Thr+Trp+Val+Arg+Ile). Compared with the best performance, the worst was verified when there was supplementation of tryptophan (T4). In conclusion, lysine is the second limiting amino acid in corn- and soybean meal-based diets for Japanese quails in the period from 1 to 21 days of age.

Introduction

Limiting amino acids are present in diets at lower concentrations than the required for optimal animal performance. In a diet, one or more amino acids can be limiting, but at different orders of limitation (BERTECHINI, 2012). This order depends basically on the composition of ingredients of the diets and on the nutritional requirements applied to their formulation.

With the use of supplemental amino acids, the practice of reducing the crude protein has become routine for nutritionists. However, this fact should be carefully evaluated, because research shows that reductions above 3% may impair the growth rate and feed efficiency, when compared with those of birds fed high-protein diets, even when the known essential amino acid requirements are met by supplementation of supplemental amino acids (DEAN et al., 2006). Thus, knowing this order is essential at the formulation of diets with crude protein reduction.

Quails require a more elevated crude protein content as compared with broilers and layers. With reduction of crude protein in the diet, the order of limitation of amino acids may vary according to the "non-meeting" of the minimum amounts of certain amino acids, thereby requiring supplementation to meet the bird requirements.

It is known that in corn- and soybean meal-based diets, methionine and lysine are the first and second limiting amino acids, respectively, for broilers and laying hens. According to MANDAL et al. (2005), in some formulations for Japanese quails, the first is methionine and the
second is threonine (MANDAL et al., 2006). However, to define the order of amino acids for Japanese quails fed corn- and soybean meal-based diets, more research is necessary.

The objective was to determine the second limiting amino acid in corn- and soybean meal-based diets for Japanese quails in the period from 1 to 21 days of age.

Material and Methods

The experiment was carried out at the Poultry Sector of the Center for Agricultural Sciences of Universidade Federal da Paraíba, Campus II, located in the municipality of Areia/PB, Brazil, in the period from September to October 2012.

We utilized 480 one-day-old Japanese quails. Birds were weighed individually and distributed in a completely randomized design, with eight treatments and five replications of fifteen birds. The average initial weight (8.23 ± 0.16 g) was balanced among the plots.

Diets were formulated utilizing corn and soybean meal as basis, meeting the nutritional requirements according to the recommendations of Silva & Costa (2009), except for the CP levels, which were reduced by seven percentage points, approximately. Each treatment had supplementation of DL-methionine plus an essential amino acid. T1: (DL-Met); T2: (T1+Lys); T3: (T1+Thr); T4: (T1+Trp); T5: (T1+Val); T6: (T1+Arg); T7: (T1+Ile); and T8: (T1+All).

Birds were housed in galvanized-wire cages provided with a tray feeder and a cup drinker. Feed and water were provided ad libitum. For the heating, incandescent bulbs were turned on according to the temperature and bird behavior. The quails were inoculated against Newcastle disease at 10 days of age, via the water they drank. The lighting program adopted until the 12th day was 24 hours (12 hours natural + 12 hours artificial light), and then it was reduced to natural light only.

The parameters evaluated were feed intake (FI), weight gain (WG) and feed conversion (FC). At the end of the experimental period, birds and their orts were weighed. The weight gain was calculated as the difference between the final weight and the initial weight, and feed conversion was determined by dividing feed intake by weight gain.

The data were subjected to variance analysis using the Statistical Analysis System (SAS, 2000). Differences between treatments were tested by the Student Newman Keuls test at 5% probability.

Results and Discussions

There was no significant difference ($P = 0.4350$) between the treatments for feed intake. Weight gain and feed conversion were influenced ($P = 0.0001$) by supplementation. Treatment 2 (Met+Lys) provided the highest WG and FC, followed by T1 (Met). Lysine is physiologically essential to growth, and its principal function is the synthesis of muscle protein, in addition to being important for the synthesis of bone tissue ad carnitine (Table 1).

![Table 1. Performance of Japanese quails aged 1 to 21 days](image)

<table>
<thead>
<tr>
<th>Tratament</th>
<th>Feed Intake (g/bird)</th>
<th>Weight Gain (g/bird)</th>
<th>Feed Conversion (g/g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Met</td>
<td>213,53</td>
<td>79,77 b</td>
<td>2,68 ab</td>
</tr>
<tr>
<td>Met+Lys</td>
<td>211,85</td>
<td>83,27 a</td>
<td>2,54 a</td>
</tr>
<tr>
<td>Met+Thr</td>
<td>217,78</td>
<td>71,00 d</td>
<td>3,07 c</td>
</tr>
<tr>
<td>Met+Trp</td>
<td>215,67</td>
<td>64,63 e</td>
<td>3,34 d</td>
</tr>
<tr>
<td>Met+Val</td>
<td>220,39</td>
<td>72,11 cd</td>
<td>3,06 c</td>
</tr>
<tr>
<td>Met+Arg</td>
<td>218,43</td>
<td>74,13 cd</td>
<td>2,95 c</td>
</tr>
<tr>
<td>Met+Ile</td>
<td>222,02</td>
<td>73,20 cd</td>
<td>3,03 c</td>
</tr>
<tr>
<td>Met+All</td>
<td>214,62</td>
<td>75,61 c</td>
<td>2,84 ab</td>
</tr>
</tbody>
</table>
Pinto et al. (2003) observed linear effect and weight gain in quails as a function of the relationships between methionine + cystine and lysine in the diet of growing birds. Moura et al. (2006), who evaluated the performance of 1 to 42-day-old quails with a crude protein level of 20.7%, did not observe significant effect of supplementation of L-lysine-HCl. The fact that the quails which consumed the diet with methionine supplementation showed the second best result corroborates Warnick & Anderson (1968), demonstrating that methionine is the first limiting amino acids for birds, and in this case, when associated with lysine supplementation, provides the best results. These results differ from the findings of Mandal et al. (2006), who stated that the second limiting amino acid for Japanese quails is threonine.

Supplementation of valine, arginine and isoleucine had the same effect on weight gain and feed conversion of birds, which was also true for the treatments containing supplemental threonine (T3) or supplementation of all amino acids (T8: Met+Lys+Thr+Trp+Val+Arg+Ile). According to Bregendahl & Roberts (2008), threonine and tryptophan are the third and fourth limiters, respectively, and they are closely followed by isoleucine and valine in corn- and soybean meal-based diets for laying hens. Compared with the best performance, the worst results were verified when there was supplementation of tryptophan (T4).

In conclusion, lysine is the second limiting amino acid in corn- and soybean meal-based diets for Japanese quails in the period from 1 to 21 days of age.

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**References**


