FEED ENZYMES IMPROVE TURKEY PERFORMANCE

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Summary

The effects of enzyme supplementation on the productive value of turkey diets were studied in two trials. In Trial 1 diets were based on soyabean meal and wheat with a high or low content of soluble pentosans. Enzyme supplementation improved the productive value of the diet based on wheat with a high content of soluble pentosans.

In Trial 2 the effects of an α-galactosidase or a pectinase preparation was studied in maize and soyabean meal based diets. On enzyme supplementation live weights at day 21 were improved for turkeys receiving either the α-galactosidase or the pectinase treated diets.

I. INTRODUCTION

The use of enzymes in poultry feeding is today common practice in Europe and there is a growing interest in the use of feed enzymes also in the North, Middle and South American states. The enzymes of interest are the arabinoxylanases (also referred to as xylanases) which degrade arabinoxylans, the major cell wall constituents in wheat, rye and triticale (Fincher and Stone, 1986; Pettersson and Åman, 1987, 1988) but also α-galactosidases and pectinases that may improve the nutritive value of soyabean meal. Soyabean meal is an important ingredient in poultry diets and, in particular, in turkey diets where it may be included at levels of about 400 g/kg in order to fulfil protein requirements. The use of both wheat and soyabean meal will combine two feedstuffs rich in dietary fibre and this may cause production disturbances since turkeys, as well as other monogastric species, are not capable of degrading dietary fibre. The detrimental effects of arabinoxylans on poultry performance are well documented (Antoniou and Marquardt, 1981; Pettersson and Åman, 1988) as well as the improvements in production that may be obtained by enzyme supplementation. The use of feed enzymes in turkey diets is not, however, as well documented as in their application in broiler diets.

Soyabean meal is rich in pectin, galactans and xyloglucans and also has a high content of indigestible, but easily fermented, oligosaccharides of the raffinose series. All together this gives a range of indigestible carbohydrates from 25 % to 33 % (dry matter basis) in solvent extracted soyabean meal which accounts for the low apparent metabolisable energy content of this protein source for poultry (approximately 9 - 10 MJ/kg).

In the current trial turkeys were fed two different types of wheat that were low (cultivar Ibis) or high (cultivar Alidos) in soluble pentosan content and viscosity. Diets formulated with these wheats were fed without or with supplementation with a dietary fibre-degrading enzyme preparation in order to determine the detrimental effects of arabinoxylans on turkey performance. In addition, experiments were carried out to assess the influence on production performance of supplementing turkey diets based on maize and soyabean meal with α-galactosidase or pectinase preparations.

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II. MATERIALS AND METHODS

(a) Animals and Diets

In Trial 1 a total of 360 male turkeys were subject to a two phase feeding regimen with diets based on wheat (680 g/kg in phase 1 and 730 g/kg in phase 2). Soyabean meal inclusion was 220 g/kg (phase 1) and 180 g/kg (phase 2). There were four dietary treatments with 9 replicates of 10 birds each. Two wheats with high (cultivar Alidos) and low (cultivar Ibis) viscosity and content of soluble pentosans were used as cereal sources and diets were fed without or with supplementation of a xylanase (Bio-Feed Wheat) preparation at 225 FXU/kg diet.

In Trial 2 a total of 240 male turkeys were fed a diet based on maize (300 g/kg) and soyabean meal (500vg/kg). The control diet, calculated to be 10 % lower in metabolisable energy than NRC recommendations, was supplemented with an α-galactosidase or a pectinase preparation. There were 6 replicates with 10 birds in each replicate.

The treatments were as follows:
- Control diet (reduced energy level).
- Control diet (reduced energy level) + α-galactosidase at 500 mg/kg
- Control diet (reduced energy level) + Pectinase at 125 mg/kg
- Control diet (reduced energy level) + Pectinase at 250 mg/kg.

(b) Measured parameters

Live weight gain was measured each week in both experiments as was group feed intakes, and feed conversion ratios were calculated. In Trial 1 a quantitative digestibility study was conducted and in addition viscosity was measured with a Brookfield viscometer (DV II +) on supernatants obtained by centrifugation of duodenal, jejunal and ileal digesta samples.

III. RESULTS

(a) Trial 1

The wheat with a high content of soluble pentosans (1.8 %) had a viscosity of 3.5 mPa s, while the wheat with a low soluble pentosan content (0.8 %) had a viscosity of 1.3 mPa s.

Table 1. Production performance in Trial 1 of male turkeys (42 days of age) fed diets based on high or low soluble pentosan wheats without (- Enzyme) or with (+ Enzyme) xylanase supplementation.

<table>
<thead>
<tr>
<th>Type of pentosans in wheat</th>
<th>High soluble - Enzyme</th>
<th>High soluble + Enzyme</th>
<th>Low soluble - Enzyme</th>
<th>Low soluble + Enzyme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed intake (g)</td>
<td>2430\textsuperscript{a}</td>
<td>2493\textsuperscript{b}</td>
<td>2384\textsuperscript{c}</td>
<td>2370\textsuperscript{c}</td>
</tr>
<tr>
<td>Live weight gain (g)</td>
<td>1759\textsuperscript{a}</td>
<td>1840\textsuperscript{b}</td>
<td>1777\textsuperscript{ab}</td>
<td>1776\textsuperscript{ab}</td>
</tr>
<tr>
<td>Feed conversion (g:g)</td>
<td>1.40</td>
<td>1.37</td>
<td>1.36</td>
<td>1.35</td>
</tr>
<tr>
<td>Ileal viscosity (mPa s)</td>
<td>11.0\textsuperscript{a}</td>
<td>2.8\textsuperscript{b}</td>
<td>3.8\textsuperscript{b}</td>
<td>3.0\textsuperscript{b}</td>
</tr>
</tbody>
</table>

\textsuperscript{abc} Means within a row without a common superscript are significantly different at P<0.05.
(b) Trial 2

Table 2. Production performance in Trial 2 of male turkeys (21 days of age) fed diets based on maize and soyabean meal and supplemented with an α-galactosidase or pectinase preparation.

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>α-Galactosidase</th>
<th>Pectinase</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>500 mg/kg</td>
<td>125 mg/kg</td>
<td>250 mg/kg</td>
</tr>
<tr>
<td>Average live weight (g)</td>
<td>538&lt;sup&gt;a&lt;/sup&gt;</td>
<td>570&lt;sup&gt;b&lt;/sup&gt;</td>
<td>561&lt;sup&gt;ab&lt;/sup&gt;</td>
</tr>
<tr>
<td>Feed conversion (g:g)</td>
<td>1.62&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.58&lt;sup&gt;a&lt;/sup&gt;</td>
<td>1.68&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

<sup>ab</sup>Means within a row without a common superscript are significantly different at P<0.05.

IV. DISCUSSION

Enzyme supplementation of the diet based on wheat with a high content of soluble pentosans improved live weight by 4.6 % and feed conversion by 2 %. Enzyme supplementation of the diet based on wheat with a low content of soluble pentosans did not improve the production values. Similar results for high and low viscosity wheats have also been demonstrated in broiler chicken trials (Veldman and Vahl, 1994).

Not only the amount of dietary fibre present in a cereal influences its productive value but also the way in which the dietary fibres of the cell wall matrix are organised will affect the cell wall degradability (Cleemput et al., 1993) and, thereby, the potential for release of nutrients enclosed within the endosperm cells. The solubilisation and disruption of the cereal cell walls will influence digesta viscosity and result in a delicate balance between the beneficial effects of solubilising and degrading the cereal cell walls and the detrimental effects on nutrient absorption due to an increased digesta viscosity. Wheat viscosity may not always correlate well with its nutritive value and other factors such as protein quantity and quality and available carbohydrate content may be equally important predictors for productive value in wheats that produce only a moderately increased digesta viscosity.

In Trial 2 the inclusion of an α-galactosidase or a pectinase preparation both improved turkey live weights but feed conversion ratios were not significantly improved. This indicates that the nutritive value of the target substrate (soyabean meal) was improved but that the energy improvement obtained was close to the 10 % by which the diets had been adjusted. However, the effect of both the α-galactosidase and the pectinase preparation on turkey performance was more pronounced at 14 days of age indicating that turkeys adapt to indigestible carbohydrates in a way similar to that of poultry receiving barley based diets (Almirall et al., 1995).

REFERENCES


