

# INVESTIGATION OF THE MODE OF ACTION OF XYLANASE ENZYMES IN IMPROVING FEED PERFORMANCE IN WHEAT BASED POULTRY DIETS

W.D. Cowan<sup>1</sup>, B. Eckenfelder<sup>2</sup>, O.B. Jøergensen<sup>3</sup>, S. Lefrancois<sup>2</sup>, L. Le Naour<sup>2</sup> and T.H. Nguyen<sup>2</sup>

<sup>1</sup> Novo Nordisk BioIndustries UK, Farnham, England

<sup>2</sup> Guyomarc'h SA, Vannes, France

<sup>3</sup> Novo Nordisk A/S, Copenhagen, Denmark

Microbial xylanases may be added to wheat containing broiler feeds to enhance feed digestibility. Conventional energy measurements (TME) do not completely reflect the observed boost in performance obtained through enzyme supplementation of feed. In order to investigate this discrepancy it was decided to isolate the individual enzyme components from the enzyme complex and compare their effects in vivo and in vitro with the original enzyme complex. In this study an endo-xylanase from *Hemicolor insolens* with a pH optimum of 6.0-7.0 was cloned into an *Aspergillus* expression system. The pure and mixed endo-xylanases were then compared in an in vitro viscosity assay and in a feeding trial using broiler chickens receiving a wheat based diet supplemented with one of the two enzyme preparations.

The substrate for the in vitro assay was the isolated NSP fraction from wheat. After hydrolysis and chemical analysis this was found to contain 60 % xylose, 37 % arabinose and 3 % glucose residues. The molecular weight distribution was 99% >DP<sub>12</sub> and 1% <DP<sub>12</sub>.

Figure 1 shows the viscosity assay performed using 200 FXU/ml (Fungal Xylanase Units) and Figure 2 the in vitro assay using 900 FXU/kg feed. In both cases although the two xylanase preparations were dosed at equal levels of xylanase activity the performance of the pure endoxylanase was slightly inferior to that of the mixed enzyme complex. As the NSP substrate also contains significant amounts of arabinose it is speculated that arabinase activity may also be an important part of the enzyme complex or that other endo/exo-xylanases may play a synergistic or supplementary role. This hypothesis is now being evaluated using a combination of the in vitro and in vivo test systems described above.

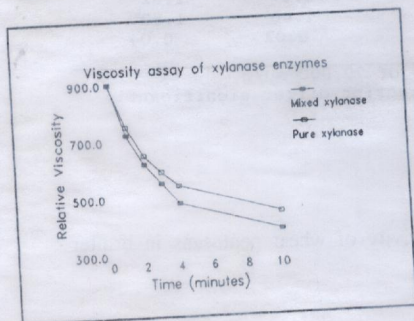


Figure 1

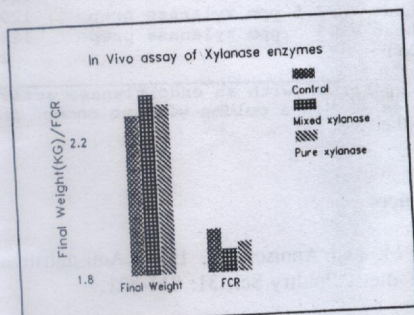


Figure 2

## USE OF ENZYMES TO IMPROVE THE NUTRITIVE VALUE OF TRITICALE IN POULTRY DIETS

M.P. Flores<sup>1</sup>, J.I.R. Castañón<sup>1</sup> and J.M. McNab<sup>2</sup><sup>1</sup> Facultad de Veterinaria, Universidad de Las Palmas de Gran Canaria, Las Palmas, Spain<sup>2</sup> Institute of Animal Physiology and Genetics Research, Edinburgh Research Station, Roslin, Midlothian, Scotland

The effect of adding 0.1% of a commercial enzyme preparation (containing  $\beta$ -glucanase, hemicellulase, cellulase and pentosanase activities) to diets containing 30 and 60% of each of three varieties of triticale (Lasko, Purdy and Proteus) was assessed in a feeding trial with male broiler chicks from 10 to 24 days of age (Table 1).

Table 1 Feed intake, weight gain and feed efficiency of the birds fed diets with or without enzyme.

	Lasko				Purdy				Proteus			
	30%		60%		30%		60%		30%		60%	
	-	+	-	+	-	+	-	+	-	+	-	+
Feed intake:												
10-17 d	349	387	359	379	410	384	350	376**	380	395	334	364*
17-24 d	610	641**	567	607	623	616	581	617	611	635	541	586*
Total	959	1028*	926	986	1033	1000	931	993	991	1030	875	950*
Weight gain:												
10-17 d	205	223**	212	238**	218	223	203	240**	211	223	167	200**
17-24 d	347	363	334	371**	344	365**	325	403**	321	375*	302	343*
Total	552	586	546	609	562	588	528	643**	532	598	469	543*
Feed efficiency:												
10-17 d	1.70	1.74	1.69	1.59	1.88	1.72	1.72	1.57*	1.80	1.77	2.00	1.82
17-24 d	1.76	1.77	1.70	1.64	1.81	1.69*	1.79	1.53**	1.90	1.69	1.79	1.71
Total	1.74	1.75	1.70	1.62	1.84	1.70*	1.76	1.54**	1.86	1.72	1.87	1.75

+:with enzyme  
-:without enzyme  
\*( $p < 0.05$ ) and \*\*( $p < 0.01$ ): level of significance with or without enzyme for each inclusion level of triticale.

When the triticales comprised 30% of the diets neither the variety nor the addition of enzyme affected the weights gained by the birds. At 60% inclusion there was again no effect of triticale variety on weight gain, but with the addition of enzyme birds fed on the diets containing Lasko and Purdy gained more weight ( $p < 0.01$ ) than those fed on the diet containing Proteus.

When the inclusion rates of the triticales were increased from 30 to 60%, feed intake and weight gain were unaffected with the exceptions that birds fed on the diets containing Proteus (both with and without enzyme) ate less feed and gained less weight ( $p < 0.05$ ) and birds fed on the diet containing Purdy and enzyme gained more ( $p < 0.01$ ). There was no relationship between the weights gained by the birds (with or without dietary enzyme) and the nitrogen or soluble pentosan contents of the triticales.

The addition of enzyme increased the weights gained of birds on all diets, in particular for the diets with the highest level of triticale and during the second week. This effect is mainly attributed to a higher ingestion of feed (but generally not significant), and therefore feed efficiency is not much affected.

These results confirm the possibilities of high inclusions levels of triticale (at least some varieties) in poultry diets. Enzyme addition could be a convenient tool to improve the nutritive value of triticale, and therefore further research is needed to establish the effect of other types and levels of enzymes.

# EFFECT OF ENZYME SUPPLEMENTATION TO DIETS BASED ON BARLEY OR WHEAT ON THE NUTRITIVE VALUE FOR BROILERS

J.B. Schutte<sup>1</sup> and C. Geerse<sup>2</sup>

<sup>1</sup> TNO Institute for Animal Nutrition and Physiology (ILOB), P.O.Box 15, 6700 AA Wageningen

<sup>2</sup> Gist Brocades, Agro Business Group, P.O. Box 1820, 2280 DV Rijswijk, The Netherlands

It is well established that the  $\beta$ -glucans in barley have an anti-nutritive activity in broiler diets. The anti-nutritive effects of these soluble nonstarch polysaccharides are manifested by a growth depression accompanied by sticky droppings. Recent studies of Choct and Annison (1990) have shown that wheat pentosans can also impair digestion in broilers, probably by acting in the same manner as the  $\beta$ -glucans in barley. Enzyme preparations have been developed by Gist-Brocades to overcome the problems with barley and wheat. The efficacy of these enzyme products was studied in broiler chicks fed on diets containing either 50% barley or 50% wheat. Addition of an enzyme complex with mainly  $\beta$ -glucanase activity to the barley based diets did improve performance of broilers significantly. In addition, daily water intake was reduced by 9%. Consequently, dry matter content of the droppings decreased. Inclusion of an enzyme complex with mainly endoxylanase activity in wheat based diets improved feed conversion efficiency significantly (Table 1). Daily water intake at a dietary level of 75 ppm xylanase preparation was decreased significantly. The results of our investigations made clear that performance of broiler chicks fed on either barley or wheat based diets can be improved by a dietary inclusion of enzymes.

**Table 1** Effect of a xylanase supplementation to a wheat-based diet on broiler chick performance (age period 6-31 days) (mean values of 18x14 birds per treatment).

Diet	Weight gain (g)	Feed/gain ratio	Water/feed ratio
50% wheat	1271 <sup>a</sup>	1.71 <sup>a</sup>	1.86 <sup>a</sup>
50% wheat + 37.5 ppm xylanase prep	1292 <sup>a</sup>	1.67 <sup>b</sup>	1.82 <sup>ab</sup>
50% wheat + 75 ppm xylanase prep	1294 <sup>a</sup>	1.66 <sup>b</sup>	1.80 <sup>b</sup>
LSD (5%)	24	0.02	0.04

\* Preparation with an endoxylanase activity of 70,000 su/g.

<sup>ab</sup> Values within a column with no common superscript differ significantly ( $p < 0.05$ ).

## References

Choct, M. and Annison, G. 1990. Anti-nutritive activity of wheat pentosans in broiler diets. Poultry Sci. 31: 811-821.