

EFFECT OF AMYLASES SUPPLEMENTATION IN RABBIT FEED ON GROWTH PERFORMANCE

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Abstract - A diet rich in starch has been supplemented with alpha-amylase (Termamyl 120L-Novo) or with amyloglucosidase AMG 200L-Novo or with the a-amylase and the amyloglucosidase as a 1 % premix. The diets were distributed to 672 weaning rabbits from 35 to 71 days of age. There were 4 treatments (control diet, 200 ppm alpha-amylase diet, 200 ppm amyloglucosidase diet and 200 ppm alpha-amylase + 200 ppm amyloglucosidase diet) and 168 rabbits per treatment. Although the diet contains 19.5 % of starch, we did not observe diarrhoea. Addition of enzymes to diet had no effect on mortality which was 20.8 % in average. Growth performance was good (39.90 g/day in average) with no differences between the diets. In this experiment, neither alpha-amylase nor amyloglucosidase or the addition of a-amylase and amyloglucosidase had any effect on mortality or on growth performance.

INTRODUCTION

Foodstuffs contain large amounts of starch, especially cereals, which is a major source of energy. The incorporation of starch to the diet requires knowledge about starch digestion. Several works have been published in this field.

Works about digestibility of starch by amylases have been done *in vitro* and compared with *in vivo* trials. The results showed that relationships between *in vitro* and *in vivo* starch hydrolysis were not established (COLONNA and CHAMP, 1990).

At weaning, young rabbits have an immature pancreatic system which is not influenced by the diet. That explains their inability to digest completely the starch of the diet before 6 or 7 weeks of age (CORRING *et al.*, 1972). Consequently, the starch reaches the ileum and the cæcum where it undergoes fermentations, which are the cause of digestive disorders : it can lead to death (CHEEKE and PATTON, 1980 ; MAERTENS, 1992 ; LEBAS, 1993).

Although *in vitro* studies were not conclusive, YU and TSEN (1993) reported that feeding experiments could be useful to confirm the effects of amylase. Moreover, experiments have already been conducted with poultry and with pigs (CAMPBELL and BEDFORD, 1992 ; CHESSON, 1993).

To try to improve starch digestibility, we have studied the effect of addition of amylases in rabbit feed on mortality and on growth performance. We chose an a-amylase and an amyloglucosidase for their complementary hydrolysis activity on starch.

MATERIALS AND METHODS

The trial was conducted at the Research and Experimentation Centre of Sanders in Souches (France) from the 2nd of may to the 7th of June 1994.

Animals and housing

672 weaning rabbits of 35 days of age were allotted by their initial weight (4 groups) and assigned to one of the 4 treatments, with 24 cages replicates per treatment.

The Hyplus rabbits were housed in a windowless building with an artificial photoperiod of 8 hours of light and 16 hours of darkness. Minimum temperature was $16.2^{\circ}\text{C} \pm 1.2$. Maximum temperature was $22.9^{\circ}\text{C} \pm 2.0$ in average. There were 7 rabbits per flat-deck cage (Density : 16.6 rabbits/m²).

Diet

The first group received the control diet (Table 1), the second group the alpha-amylase (Termamyl 120L) supplemented diet (200 ppm), the third group the amyloglucosidase (AMG 200L-Novo) supplemented diet (200 ppm) and the fourth group amylase (200 ppm) and amyloglucosidase (200 ppm) supplemented diet. The composition and enzymes activity are shown in Table 2.

Table 1 : Composition of the control diet (% as fed)

Wheat	16.5
Molasses	6.0
Wheat bran	26.0
Alfalfa meal	30.0
Sunflower meal	12.0
Soja bean meal	5.2
Vegetable oil	1.0
Vitamin and Minerals mix	2.3
Premix for enzyme	1.0

Controlled nutritive analysis of the control diet (% as fed)

Dry Matter	87.7
Ash	8.4
Starch	19.5
Crude Protein	17.2
NDF	27.1
ADF	15.6
Crude Fiber	12.7
Lysine	0.74
Methionine	0.34
DE (kcal/kg)	2500

NDF : Neutral Detergent Fiber

ADF : Acid Detergent Fiber

DE : Digestible energy

Starch came from wheat (16.5% in the diet) and wheat bran (26% in the diet). The enzymes were added as a 1% premix. Feed and water were provided *ad libitum*.

Table 2 : Enzyme activities as declared by the supplier (Novo)

Enzyme		Termamyl 120L	AMG 200L
alpha-amylase activity	KNU/g ⁽¹⁾	120	-
amyloglucosidase activity	AGU/ml ⁽²⁾	-	200

⁽¹⁾ degradation of soluble starch

⁽²⁾ degradation of maltose

Records and control

Rabbits were weighed at 35 days. The feed intake and weight of animals were recorded for each cage at 44 and 71 days of age. Mortality was noted daily.

Mean results for weight, average daily gain, feed intake, feed conversion and mortality were calculated for each period (35-44 days and 44-71 days) and for the total growing period between 35 and 71 days.

Statistical analysis.

Analysis of variance was carried out on the results according to a factorial model (treatment and group of initial weight) (SAS, 1988). The statistical analysis of treatment effect on mortality results was carried out with a Chi Square test.

RESULTS AND DISCUSSION

Mortality (Table 3)

Mortality was low from 35 to 44 days (1.49 %) but very high from 45 to 71 days (19.05%). It was mainly due to caecal paresis although starch was high in the diet in order to induce diarrhoea and to test the efficacy of the enzymes.

There is no significant effect of the enzyme supplementations on mortality.

Table 3 : Effect of the enzyme supplementations on mortality

Treatment	CD	CD+AM	CD+AG	CD+AM+AG	Total	Probability
Mortality (%)						
35-44 days	1.19	1.19	1.19	2.38	1.49	ns
45-71 days	16.67	22.62	18.45	18.45	19.05	ns
35-71 days	17.86	23.81	19.64	20.83	20.54	ns

CD : Control Diet ; CD+AM : Control Diet + Amylase (200 ppm) ; CD+AG : Control Diet + Amyloglucosidase (200 ppm) ; CD+AM+AG : Control Diet + Amylase (200 ppm) + Amyloglucosidase (200 ppm).

The α -amylase and the amyloglucosidase had no effect on the digestive disorders observed in this trial but we were in a special sanitary situation (caecal paresis) whereas we wanted to induce diarrhoea with a high starch diet.

Growth performance (Table 4)

General performances were good (40 g/d growth rate and 3.06 feed conversion) but there were no effects of enzymes on growth performance.

Table 4 : Effect of alpha-amylase and amyloglucosidase on performance of growing rabbits

Treatment	CD	CD+AM	CD+AG	CD+AM+AG	MSE	Treatment	Group of initial weight	I
35-44 days								
DWG (g/day)	38.59	37.73	37.99	38.77	6.52	NS	NS	NS
Intake (g)	845	835	837	850	89	NS	**	NS
Feed/Gain	2.43	2.46	2.45	2.44	0.24	NS	*	NS
44-71 days								
DWG (g/day)	41.90	39.64	40.76	39.47	3.96	NS	NS	NS
Intake (g)	3683	3496	3636	3456	317	NS	**	NS
Feed/Gain	3.26	3.27	3.30	3.24	0.27	NS	**	NS
35-71 days								
DWG (g/day)	41.07	39.16	40.07	39.29	3.29	NS	NS	NS
Intake (g)	4527	4331	4473	4306	339	NS	**	NS
Feed/Gain	3.06	3.07	3.10	3.04	0.18	NS	**	NS

NS : Non Significant ; MSE : Mean Square Error ; ** P<0.001 ; * p<0.05 ; I : interaction

In our experiment, the enzymes had no effect on the growth of rabbits but we wonder if the dose used was sufficient or not. Actually, we had chosen a pig dose. It seems to be high for rabbit, but YU and TSEN (1993) reported an *in vitro* study that α -amylase was acid labile and they proposed to test its efficacy in rabbit diets. So, with such a dose, we could expect that some of the enzyme would still be active after the stomach of the rabbit (pH = 2.0 to 3.2).

On the other hand, we don't know the effect of the temperature during the production of the feed at 65°C during the pelleting process. YU and TSEN reported in their *in vitro* study that α -amylase activity is enhanced with 80°C during 15 min in a feed mixture but is reduced in a phosphate buffer.

Finally, because of the unknown effect of the pH and of the temperature on the stability of the activity of both enzymes, it's difficult to know whether the dose was sufficient. Actually, the main problem is that there is no method to dose the activity of enzymes in the feed.

According to this experiment, in a context of caecal paresis, alpha-amylase and amyloglucosidase are not efficient in rabbit production.

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Effet d'une supplémentation de l'alimentation par différentes amylases sur les performances du lapin en croissance - Un régime riche en amidon a été supplémentation avec une alpha-amylase (Thermamyl 120L-Novo) ou avec une amyloglucosidase (AMG 200L-Novo) ou avec l'alpha-amylase et l'amyloglucosidase sous forme de prémix 1 %.

Les aliments ont été distribués à 672 lapins de 35 à 71 jours. Il y avait 4 traitements (témoin, 200 ppm d'alpha-amylase, 200 ppm d'amyloglucosidase, 200 ppm d'alpha-amylase et 200 ppm d'amyloglucosidase) et 168 lapins par traitement.

Malgré la teneur élevée en amidon (19.5 %), le régime n'a pas induit de diarrhées.

L'addition d'enzymes au régime n'a pas eu d'effet sur la mortalité, qui était de 20,8 % en moyenne. Les performances zootechniques étaient bonnes (39,90 g/jour en moyenne), sans différence entre les régimes.

Dans cette expérience, ni l'alpha-amylase, ni l'amyloglucosidase, ni l'addition d'alpha-amylase et d'amyloglucosidase n'ont eu d'effet sur la mortalité et sur les performances zootechniques.
