

## SEPIOLITE (EXAL) DECREASES MICROBIAL COLONIZATION IN THE GASTROINTESTINAL TRACT OF YOUNG BROILERS FED BARLEY-WHEAT BASED DIETS

LA SEPIOLITA (EXAL) REDUJO LA PROLIFERACIÓN MICROBIANA EN EL TRACTO DIGESTIVO DE POLLITOS ALIMENTADOS CON DIETAS BASE DE CEBADA-TRIGO

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### ADDITIONAL KEYWORDS

Enzymes. Purine bases.

### PALABRAS CLAVE ADICIONALES

Enzimas. Bases púricas.

### SUMMARY

A trial with caged housed male broiler chicks was conducted to study the effects of sepiolite (Exal; 20g/kg) and/or crude enzyme preparations ( $\beta$ -glucanase and arabinoxylanase) on the performance and purine bases concentration in excreta of broiler chickens fed maize-barley-wheat based diets. Neither enzymes nor sepiolite affected significantly feed intake and feed conversion ratios. However, significant increases were detected in the body weight gain with the enzyme treatments (491 vs 469 g/bird,  $p < 0.05$ ). Concentration of purine bases in excreta was significantly lower ( $p < 0.05$ , Day 9) in the sepiolite treatments pointing to a reduced microbial activity in the intestinal tract of young birds fed diets diluted with 20g/kg of sepiolite.

da-trigo sobre los rendimientos productivos y la proliferación microbiana intestinal en pollos broilers criados de 6 a 21 días de edad. Ni la suplementación con enzimas, ni la dilución de la dieta con sepiolita afectaron al consumo medio diario y los índices de conversión de la dieta. Sin embargo, la suplementación enzimática mejoró significativamente la ganancia de peso de los animales (491 vs 469 g/pollo,  $p < 0,05$ ). La suplementación de la dieta con sepiolita provocó un descenso en la concentración de bases puricas en las heces recogidas en los días 9 ( $p < 0,001$ ) y 21 ( $p > 0,05$ ) de edad, sugiriendo un efecto intensivo de la sepiolita sobre la actividad microbiana en el tracto digestivo.

### RESUMEN

En el presente ensayo se estudió el efecto de la suplementación con sepiolita (Exal; 20g/kg) y/o preparados enzimáticos ( $\beta$ -glucanasa y arabinoxilanasas) en dietas base de maíz-ceba-

### INTRODUCTION

It is well established that water-soluble non-starch polysaccharides (sNSP), mainly  $\beta$ -glucans in barley and arabinoxylans in wheat have antinutritive properties in chicks

(Esteve-Garcia *et al.*, 1997). Mechanisms through which sNSP reduce digestibility of nutrients and productive performances have been described, such as increases on the ileal viscosity (Choct *et al.*, 1996); changes on the intestinal passage rate (Almirall and Esteve-Garcia, 1994) or increases on the intestinal microbial activity (Choct *et al.*, 1996). To date the most efficient way to override these problems has been the use of commercial enzymes, glucanase and arabinoxylanase, which promote reductions on the gut viscosity and increases on the productive performances of animals (Esteve-Garcia *et al.*, 1997). Alternatively, other feed additives have been also proposed, such as clays which with a high water holding capacity and effects on the physico-chemical parameters of digesta could interfere intestinal microflora (Schutte and Langhout, 1998).

The objective of this study was to evaluate the effects of supplementing maize-barley-wheat based diet with enzymes and/or sepiolite on the productive performances (body weight gain and food:gain ratios) and the microbial concentration determined as purine bases index in excreta of broiler chickens from 6 to 21 days old.

#### MATERIALS AND METHODS

One-day-old male broiler chickens were fed a proprietary starter diet for a 5 days pre-experimental period and on day 6 (initial BW=102.0±2.8) were randomly allocated to 48 cages (4 birds per cage). The body weight of each group was recorded and the group was

randomly assigned to one of four dietary treatments. Treatments consisted of a barley, wheat and maize based diet (formulated according to NRC, 1994; with 204g maize, 220g barley, 220g wheat, 280g soybean meal (46 percent CP) and 35g tallow per kg of diet) either unsupplemented (Control) or supplemented with 20g/kg of sepiolite (EXAL UE-562, TOLSA, S.A. Madrid), 0.44 g/kg of  $\beta$ -glucanase and arabinoxylanase 50:50 (1mg/g of wheat+barley; Capsozyme C and T, EC-3216 and EC-3218 respectively, ITPSA, S.A. Barcelona), or both simultaneously. The experiment consisted of 12 replicates per treatment, each cage being the experimental unit. Food intake and body weight were recorded from day 6 to 21. On days 9 and 21, a sample of excreta was collected with the objective of determining microbial concentration using purine bases (adenine + guanine) as an index (Martin Orue *et al.*, 1995). Data were examined by a factorial 2 x 2 analysis of variance (Steel and Torrie, 1980).

#### RESULTS AND DISCUSSION

In **table I** are presented the average value of body weight gain, feed:gain ratios and purine bases concentration in faeces collected from 9 and 21 days-old chickens. Neither enzymes nor sepiolite promoted significant differences on feed intake (878±7.5 g/bird). Body weight gain was significantly improved by enzyme supplementation (496 vs 467;  $p < 0.05$ ), resulting in not significant ( $p > 0.05$ ) decreases in feed:gain ratios (1.80 vs 1.85). Similar results have been described by Ouhida

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**Table I.** Effect of sepiolite and enzymes supplementation on body weight gain (BWG, g/bird), feed:gain ratios (g/g) and purine bases concentration in excreta of growing broiler from 6 to 21 days old. (Efectos de la suplementación con sepiolita y enzimas sobre la ganancia media de peso, los índices de conversión del alimento y la concentración de bases puricas en las heces de pollos criados desde el día 6 hasta el día 21 de edad).

Sepiolite level (g/kg)	Enzyme (-)		Enzyme (+)		s.e	Enz.	Sep.	Sep*Enz	
	0	20	0	20					
BWG	467	471	496	487	8.6	*	NS	NS	
Feed:gain	1.83	1.88	1.78	1.83	0.033	NS	NS	NS	
PB (mg/g OM)									
9 day	Guanine	4.46	3.40	4.32	3.60	0.222	NS	***	NS
	Adenine	3.25	2.72	3.09	2.35	0.197	NS	***	NS
	G +A	7.71	5.96	7.41	5.95	0.394	NS	***	NS
21 day	Guanine	5.92	5.40	5.66	5.60	0.309	NS	NS	NS
	Adenine	5.13	4.46	4.75	4.59	0.247	NS	NS	NS
	G +A	11.05	9.86	10.41	10.14	0.522	NS	NS	NS

Values are means of 12 observations per treatment and their standard error (s.e.).  
NS, not significant; \*,  $p < 0.05$ ; \*\*\*,  $p < 0.001$ .

*et al.*, (2000a), who report decreases on the ileal viscosity due to enzyme supplementation, associated with increases on the nutrient digestibility and chick performances. Sepiolite incorporation in the diet did not modify body weight gain (471 vs 467,  $p > 0.05$ ), and tended to increase feed:gain ratios by 2 percent.

Purine bases concentration (mg/g OM) in excreta was highly affected by sepiolite (5.95 vs 7.56,  $p < 0.001$ ) in young birds (day 9) as previously referred by Schutte and Langhout (1998). Mechanisms explaining microbial concentration decreases with sepiolite could be associated with an improved organic matter digestibility (Ouhida *et al.*, 2000a) linked to reduced digesta viscosity (Schutte and Langhout, 1998) or changes on the passage rates

of digesta (Ouhida *et al.*, 2000b). However, despite known effects of enzymes on digestibility, no modification was promoted by enzyme supplementation on excreta microbial concentration, which could suggest specific mechanism associated with sepiolite in the digestive content.

It is concluded that sepiolite supplementation (20g/kg) may prevent microorganisms proliferation in the intestinal tract of starter broilers fed on maize-barley-wheat based diets, as indicated by excreta microbial concentration decreases.

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## REFERENCES

- Almirall, M. and E. Esteve-García. 1994. Rate of passage of barley diets with chromium oxide. Influence of age and poultry strain and effect of  $\beta$ -glucanase supplementation. *Poult. Sci.*, 73: 1433-1440.
- Choct, M., R.J. Hughes, J. Wang, M.R. Bedford, A.J. Morgan and G. Annison. 1996. Increased small intestinal fermentation is partly responsible for the anti-nutritive activity of non-starch polysaccharides in chickens. *Br. Poult. Sci.*, 37: 609-621.
- Esteve-García, E., J. Brufau, A. Pérez-Vendrell, A. Miquel and K. Duven. 1997. Bioefficacy of enzyme preparation containing  $\beta$ -glucanase and xylanase activities in broiler diets based on barley or wheat in combination with Flavomycin. *Poult. Sci.*, 76: 17-28.
- Martin Orue, S.E., J. Balcells, J.A. Guada and C. Castrillo. 1995. Endogenous purine and pyrimidine derivatives excretion in pregnant sows. *Br. J. Nutr.*, 73: 375-385.
- NRC. 1994. National Research Council Nutrient Requirements of Poultry. 9<sup>th</sup> revised ed. National Academy Press. Washington, DC.
- Ouhida, I., J.F. Pérez, J. Gasa and F. Puchal. 2000a. Enzymes ( $\beta$ -glucanase and arabinoxylanase) and/or sepiolite supplementation and the nutritive value of maize-barley-wheat based diets for broiler chickens. *Br. Poult. Sci.*, 41: 617-624.
- Ouhida, I., J.F. Pérez, J. Piedrafita and J. Gasa. 2000b. The effect of sepiolite in broiler chicken diets of high, medium and low viscosity. Productive performance and nutritive value. *Anim. Feed Sci. Technol.*, 85: 183-194.
- Schutte, J.B. and D.J. Langhout. 1998. Effect of dietary inclusion of sepiolite in wheat based diets in broiler performance. 10<sup>th</sup> European Poultry Conference Jerusalem, Israel, June 21-26, 1998; Abstracts, pp. 95.
- Steel, R.G.D. and J.H. Torrie. 1980. Principles and procedures of statistics. A Biometrical Approach. (U.S.A., McGraw-Hill).

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