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Mannan oligosaccharides as growth promoter in finishing rabbit: effect on *in vivo* performance and carcass traits

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ABSTRACT - Four groups each consisting in 440, 60 days old rabbits, were fed, respectively, four experimental diets: (1) MOS_0.5 (Bio-Mos® at 0.5 g/kg); (2) MOS_1.0 (Bio-Mos® at 1.0 g/kg); (3) MOS_1.5 (Bio-Mos® at 1.5 g/kg) and (4) antibiotics (AGP, colistin sulphate 144 mg/kg; tylosin 100 mg/kg and oxytetracyclin 1000 mg/kg). Up to slaughter age (82 days of age) mortality rate was recorded daily. For each group, 64 rabbits were controlled weekly for live weight to calculate daily weight gain (DWG). Feed intake (and, by consequence feed conversion ratio) was measured, weekly, per group. At 82 days 16 rabbits per group were slaughtered and carcass traits were recorded. No differences were recorded among groups in live weight at different age and in daily weight gain but, in particular during the last week, AGP and MOS_0.5 groups showed higher feed intake and less favourable feed conversion ratio. MOS_1.0 group showed significantly higher incidence of empty gastro-intestinal tract but not differences were found for dressing out percentage. Perirenal fat showed a lower incidence in MOS than in AGP groups.

Key words: Rabbits, Mannan oligosaccharides, Performance, Carcass traits.

Introduction – Recently the European Community place a general ban of antibiotic used as growth promoter in animal production. In rabbit production, due to the high stress under intensive farm condition, it is necessary to find alternative molecules to antibiotics in order to prevent digestive disorders around weaning (30–60 days of age) and also to promote the animal growth in the finishing period (61 days – slaughter age). Mannan oligosaccharides (MOS), derived from the outer cell wall of yeast, are a prebiotic able to improve gut health, immune system as well as animal performance in broilers (Hooge, 2004a), turkeys (Hooge, 2004b) and piglets (Miguel *et al*., 2004). Little research has been conducted in rabbits. Bersenyi and Gippert (1995) and Girard *et al*. (1997) did not report improvements in rabbit performance with MOS in smaller scale trials. Fonseca *et al*. (2004) showed that MOS was similar or superior to performance with oxytetracycline. Mourao *et al*. (2006) found no differences in live weight, daily weight gain, feed intake and feed conversion ratio in rabbits fed AGP or different concentrations of MOS from 32 to 67 days. The aim of our research was to evaluate the effect of MOS vs. antibiotics during finishing period on rabbit performance and carcass traits. The use of antibiotic until the conventional slaughter age was possible due to the presence, in the area where the trial was made, of a local market which requires "heavy" rabbits slaughtered over 100 days of age.

Material and methods – Four groups each consisting in 440, 60 days old rabbits, were fed, respectively, 4 experimental diets: (1) MOS_0.5 (Bio-Mos®, Alltech Inc., USA at 0.5 g/kg); (2) MOS_1.0 (Bio-Mos® at 1.0 g/kg); (3) MOS_1.5 (Bio-Mos® at 1.5 g/kg) and (4) antibiotics (AGP, colistin sulphate 144 mg/kg; tylosin 100 mg/kg and oxytetracyclin 1000 mg/kg). The common basal diet was a commercially diet which met the nutritive requirements for fattening rabbits according to Gidenne (2000). Up

to slaughter age, mortality rate was recorded daily. For each group, 64 rabbits (sex ratio 1:1) were used to measure weekly live weight to calculate daily weight gain (DWG). Feed intake and conversion ratio (FCR) were measured weekly as average per group. At 82 days, 16 rabbits per group (sex ratio 1:1) were slaughtered. On the carcasses, according to Blasco *et al.* (1992) recommendations, the following weights were recorded: empty gastrointestinal tract, skin, distal legs and tail. From the remaining commercial carcasses, weighed before and after refrigeration at 4°C for 24h, the head and internal organs were dissected and weighed to obtain the "reference carcass". Differences among groups for live weight, DWG and carcass traits were analysed by ANOVA (SAS, 2000). Differences in mortality rate were tested by chi-square test.

Results and conclusions – During the trial, live weight (Table 1) did not differ among groups and daily weight gain showed significant differences only during the first week probably due to the response of the animal to diet shift at 60 days. In particular, MOS_1.0 group showed a significantly ($P<0.05$) lower daily weight gain than other groups. Unfortunately, it was not possible to record individually feed intake and so made a statistical analysis. However, exclusive of the second week, AGP and MOS_0.5 groups showed higher feed intake than the other groups (Table 2). Feed conversion ratio was, in average, more favourable for MOS_1.5 and 1.0 groups (4.06 and 4.33, respectively) than AGP and MOS_0.5 groups (4.56 and 4.58, respectively). Mortality rate was not statistically different among groups (on average 3.46%). MOS_1.0 group showed a significant ($P<0.05$) higher incidence of empty gastro intestinal tract on live weight in respect of MOS_0.5 and AGP groups (Table 3). MOS_1.0 group showed also a higher incidence of empty gastro-intestinal tract than MOS_1.5 group but the differences did not reach the statistical significance. The incidence of liver on reference carcass was significantly higher in AGP and MOS_1.0 groups. Net hot dressing out did not significantly differ

Table 1. In vivo performance of rabbits.

	Live weight				Daily weight gain		
days	60	67	74	82	61-67	68-74	75-82
MOS_0.5	1705	1954	2156	2434	35.6[a]	28.8	34.8
MOS_1.0	1751	1963	2199	2473	30.2[b]	33.8	34.2
MOS_1.5	1703	1968	2191	2467	37.8[a]	31.8	34.5
AGP	1714	1971	2194	2443	36.8[a]	31.9	31.1
MSE	1650	1859	2432	3014	7.75	8.69	9.95

a, b: P<0.05; MSE: mean square error.

Table 2. Average feed intake and feed conversion ratio per group.

	Feed intake (g/d)			Feed conversion ratio		
Days	62-67	68-74	75-82	61-67	68-74	75-82
MOS_0.5	132.9	144.3	174.0	3.73	5.01	5.00
MOS_1.0	122.5	150.1	153.1	4.06	4.44	4.48
MOS_1.5	123.4	141.0	155.3	3.26	4.43	4.50
AGP	131.6	149.2	168.8	3.58	4.68	5.42

Table 3. Rabbit live weigh and some carcass traits.

	LW g	Skin %LW	EGUT %LW	CC g	RefC g	Head %RefC	Liver %RefC	Kidney %RefC
MOS_0.5	2434	15.9	8.48[b]	1393	1120	12.3	8.54[ab]	1.45
MOS_1.0	2468	15.3	9.21[a]	1454	1165	11.1	9.43[a]	1.39
MOS_1.5	2461	15.9	8.83[ab]	1458	1183	11.4	7.87[b]	1.41
AGP	2451	16.0	8.49[b]	1395	1123	11.2	9.15[a]	1.25
MSE	3172	0.77	0.41	1249	1078	1.05	3.86	0.15

LW: live weight; EGUT: empty gastro intestinal tract; CC: commercial chilled carcass; RefC: reference carcass; a, b: P<0.05; MSE: mean square error.

among groups (Table 4). Rabbit from MOS_0.5 group showed lower values of carcass circumference even if the differences did not reach the statistical significance. AGP group showed significantly (P<0.05) higher percentage of perirenal fat than MOS_0.5 and 1.0 groups. The higher incidence of empty gastro intestinal tract of MOS_1.0 group rabbits not followed by a significant decrease of net dressing out percentage could indicate a high development of intestinal *villi*. On this regard, Mourao *et al*. (2006) observed an increase in intestinal *villi* height when MOS was used in alternative to antibiotics. The positive effect on *villi* can improve the nutrient uptake from intestine, which could result in improved feed conversion ratio. MOS_0.5 and AGP groups showed a similar value of FCR, indicating a poor effect of 0.5 g/kg of MOS on gastro-intestinal health. Comparing MOS_1.0 and 1.5 groups, more difficult is to justify the higher (even if not significant) incidence of empty gastro-intestinal tract in MOS_1.0 group accompanied by a higher FCR. As partial justification of the results, Mourao *et al*. (2006) showed an increasing in *villi* height from 1.0 to 1.5 g/kg of MOS with a not significantly increase in FRC. According to Fritts and Waldroup (2003) in turkeys, MOS at 0.5 and 1.0 g/kg significantly and linearly decreased the percentage of abdominal fat. Further analysis are in progress in order to measure the nutrient digestibility and the composition and activity of microbial population of rabbit GUT. However, on the basis of our results it is possible to affirm that mannan oligosaccharides can be used as valuable alternative to antibiotics as growth promoter during rabbit finishing.

Table 4. Some carcass traits.

	NHDO %	CL cm	CC cm	PF %RefC	IF %RefC	ISF %RefC
MOS_0.5	65.5	37.8	18.5	0.83^{b}	0.55	0.65
MOS_1.0	65.6	38.9	19.2	0.78^{b}	0.71	0.59
MOS_1.5	66.1	38.6	19.3	0.97^{ab}	0.61	0.61
AGP	65.7	38.1	19.0	1.13^{a}	0.64	0.63
MSE	0.72	8.56	3.71	0.12	0.76	0.052

NHDO: net hot dressing out; CL: carcass length; CC: carcass circumference; PF: perirenal fat; IF: inguinal fat; ISF: interscapolar fat; a, b: P<0.05; MSE: mean square error.

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