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Use of mannan oligosaccharides during “post-weaning enteric syndrome” in rabbits: effect on *in vivo* performance from 35 to 60 days

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ABSTRACT - Four groups, each consisting of 684 weaned (35 days) hybrid Hyla rabbits were fed *ad libitum* the same commercial concentrate supplemented, respectively, with antibiotics (AGP group: colistin sulphate 144 mg/kg; tylosin 100m g/kg and oxytetracyclin 1000 mg/kg) or with mannan oligosaccharides (MOS) at 0.5 (group MOS_0.5), 1.0 (group MOS_1.0) and 1.5 g/kg (group MOS_1.5). Up to 60 days, 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. No differences were observed for live weight during the trial, while DWG showed an alternate trend, in general, significantly lower for AGP group, exclusive of the third week (49-56 days). Exclusive of the first week of the trial feed intake was higher for AGP than the other groups and the feed conversion ratio was more favourable for MOS groups. Mortality rate was significantly higher (34.2%) in AGP groups. The lowest mortality was recorded in MOS_1.0 group (7.75%).

Key words: Rabbits, Mannan oligosaccharides, Mortality rate, *In vivo* performance.

Introduction – The period “around weaning” is very critical in rabbit production. In fact, a combination of stress factors increases rabbit susceptibility to post-weaning digestive disorders. Specific pathogens such as *Escherichia coli* O103 or *Clostridium spiroforme* can lead to mortalities after weaning in excess of 20% (Peeters *et al.*, 1995). However, the most common disorder in rabbit production is the occurrence of an enteritis complex which has no identified pathogenic agent (post-weaning enteric syndrome). To prevent post-weaning disorders, prophylactic antimicrobial medication is normally used in growing rabbits. However, the large use of antibiotics (not only in animal production) resulted in the occurrence of antibiotic resistant bacteria. As a consequence, the European Community place a general ban of antibiotic used as growth promoter from January, 2006. Prebiotics and in particular mannan oligosaccharides (MOS) are recently studied as a possible alternative to antibiotics. Little research has been conducted on the effect of MOS on rabbit performance. Fonseca *et al.* (2004) recorded no difference between oxytetracyclin and MOS at 2 g/kg on rabbit growth performance while mortality rate was significantly lower in MOS group. Mourao *et al.* (2006), comparing the effect of MOS at 1 – 1.5 and 2 g/kg *vs.* Zn-Bacitracin on growing rabbits from 32 to 67 days, found no differences for both mortality and growth rate. The present paper studied the effect of MOS *vs.* antibiotics on rabbit *in vivo* performance from 35 to 60 days during a period of “post-weaning enteric syndrome”.

Material and methods – A total of 2736 weaned (35 days) hybrid Hyla rabbits were randomly divided into 4 groups hosted in the same shed. Four experimental treatments applied to a common

basal diet were used: (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 manufactured diet, which met the nutritive requirements for fattening rabbits according to Gidenne (2000). Up to 60 days mortality rate was recorded daily. For each group, 64 rabbits (sex ratio 1:1) were used to measure weekly live weight in order to calculate daily weight gain (DWG). Feed intake and feed conversion ratio (FCR) were measured weekly as average per group. Differences among groups for live weight and DWG were analysed by ANOVA (SAS, 2000). Differences in mortality rate were tested by chi-square test.

Results and conclusions – During the second and the third week of the trial an episode of post-weaning enteric syndrome occurs and mortality rate in the rabbit farm exceeds the 35%. According to other authors (Fonseca *et al.*, 2004; Mourao *et al.*, 2006) no differences were found for live weight among groups (Table 1). Daily weight gain was alternatively significantly higher for MOS or AGP groups, but the average values during the trial was not much different among groups: 38.85 g/d for MOS_0.5; 39.45 g/d for MOS_1.0; 37.78 d/d for MOS_1.5; 38.12 g/d for AGP (Table 1).

Table 1. *In vivo* performance of rabbits from 35 to 60 days.

days	Live weight (g)					Daily weight gain (g/d)			
	35	42	49	56	60	35-42	42-49	49-56	56-60
MOS_0.5	747.4	1043	1242	1487	1705	44.00 ^a	30.00 ^b	38.02 ^{ABb}	43.38 ^{Aa}
MOS_1.0	749.3	1059	1250	1503	1751	44.32 ^a	36.19 ^{ab}	42.84 ^{ABb}	34.46 ^{Bb}
MOS_1.5	751.3	1027	1260	1476	1703	41.03 ^b	37.92 ^a	36.71 ^{Bc}	35.46 ^{ABb}
AGP	758.9	1026	1200	1534	1714	38.22 ^c	31.60 ^b	45.18 ^{Aa}	37.47 ^{ABb}
MSE	1446	2141	2246	1956	1650	9.29	6.02	7.11	8.23

A, B: $P < 0.01$; a, b: $P < 0.05$; MSE: mean square error.

Unfortunately, it was not possible to record individual daily feed intake and, by consequence, a statistical analysis for this parameter as well as for feed conversion ratio was not possible (Table 2). However, exclusive of the first week of the trial, AGP group showed a higher feed intake than MOS groups. In the periods 35-42, 49-56 and 56-60 days MOS_0.5 group showed a feed intake closer that of AGP rabbits, while the groups MOS_1.0 and MOS_1.5 showed not much different feed intake. According to DWG, also feed conversion ratio showed an alternate trend. However, AGP group showed a less favourable FCR along the trial (2.92); MOS_0.5 and MOS_1.5 groups showed similar values of FCR (2.75 and 2.76, respectively) while lower value was recorded for MOS_1.0 group (2.64).

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

days	Feed intake (g/d)				Feed conversion ratio			
	35-42	42-49	49-56	56-60	35-42	42-49	49-56	56-60
MOS_0.5	80.68	89.36	112.6	141.3	1.83	2.98	2.96	3.26
MOS_1.0	84.07	94.20	105.5	123.8	1.90	2.60	2.46	3.59
MOS_1.5	85.96	95.02	107.0	124.7	2.10	2.51	2.91	3.52
AGP	79.43	96.42	118.4	147.7	2.08	3.05	2.62	3.94

Great differences among groups were recorded for mortality rate (Table 3). During the first week, no deaths were recorded. During the second and the third weeks, when the mortality rate was very high in the farm, MOS_1.0 group do not showed dead rabbits. AGP group was, obviously, in line with the general trend of the farm (12.72 and 15.50%, respectively for the second and the third week). During the second week

MOS_0.5 group showed a mortality rate (11.40%) not statistically different from AGP group but significantly ($P<0.05$) higher than MOS_1.5 group (8.19%). During the third week, MOS_1.5 showed a mortality rate (8.92%) not statistically different from MOS_0.5 group (6.29%). Finally, during the last week of the trial mortality rate was recorded only for AGP (6.29%) and MOS_1.0 groups (7.75%).

Table 3. Mortality rate (%) along the trial.

days	35-42	42-49	49-56	56-60	35-60
MOS_0.5	0	11.40	6.29	0	17.69
MOS_1.0	0	0	0	7.75	7.75
MOS_1.5	0	8.19	8.92	0	17.11
AGP	0	12.72	15.50	6.29	34.21
Statistical differences					
MOS_0.5 vs. MOS_1.0	**
MOS_0.5 vs. MOS_1.5	.	*	NS	.	NS
MOS_0.5 vs. AGP	.	NS	**	.	**
MOS_1.0 vs. MOS_1.5	**
MOS_1.0 vs. AGP	.	.	.	NS	**
MOS_1.5 vs. AGP	.	**	**	.	**

NS: not significant; *: $P<0.05$; **: $P<0.01$.

As a consequence, during the entire period of the trial mortality rate was significantly higher ($P<0.01$) for AGP group (34.2%). MOS_0.5 and MOS_1.5 groups showed similar percentage of deaths (17.7 and 17.1%, respectively) while significantly ($P<0.01$) lower mortality rate was observed for MOS_1.0 group (7.75%). The results of the present trial showed that mannan oligosaccharides have a positive effect during the occurrence of high mortality rate on rabbit farm. Antibiotics were not able to reduce mortality, probably due to a multi-factorial agents as well as the presence of antibiotic-resistant bacteria. In general, MOS reduces mortality rate and the best concentration was 1.0 g/kg. Probably 0.5 g/kg is a not sufficient level to guarantee a correct sanitary status of gastro-intestinal tract. More difficult is to explain the mortality rate of MOS_1.5 group, higher than MOS_1.0 group. Other authors (Mourao *et al.*, 2006), under normal mortality condition, found similar mortality rate (3.75%) in rabbits fed MOS at 1.0 and 1.5 g/kg and lower at 2.0 g/kg (1.25%). The same authors found also an increasing total bacterial count (TBC) in the caecal content from MOS_1.0 to MOS_2.0 groups. In our case, preliminary results indicate a TBC higher in MOS_1.0 than MOS_1.5 group. MOS at 1.0g/kg seems also to improve *in vivo* performance (in particular FCR) better than 1.5 g/kg. On this regard our results are in line with Mourao *et al.* (2006) that observed a slightly (but not significant) increase of FCR when MOS concentration increase in the diet. In conclusion, further analysis are in progress to study the gastro-intestinal tract of the rabbit under trial (microbiological analysis, *in vitro* gas tests) but mannan oligosaccharides seem a valuable alternative to antibiotics also in order to prevent the occurrence of high mortality period in rabbit farm.

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