EFFECT OF A POLYHERBAL MIXTURE OF *Saccharum officinarum* AND OF *Acacia concinna* ON THE OOCYSTAL EXCRETION, ZOOTECHNICAL PERFORMANCE AND MEAT QUALITY OF GROWING RABBITS

Atkinson A.[1], Espinosa-Ayala E.[2], Hernández P.A.[1], Le Roux J.F[1], Mendoza G.D.[3], Pulido-Huertas S.[3], Velázquez-Cruz A.L.[1], Prigent A.Y.[4], Colin M.[5]

[1]Nuproxa, 3 Rue Jean Rostand, 22 440 Ploufragan (France)
[2]Centro Universitario UAEM Amecameca, Universidad Autónoma del Estado de México, km 2.5 Carr. Amecameca-Ayapango, 56900, Amecameca, México (Mexique)
[3]Doctorado en Ciencias Agropecuarias, Universidad Autónoma Metropolitana Xochimilco, Calz, del Hueso 1100,
[4]Earl 3L, Coat Izella N°4, 29830 - Ploudalmézeau (France)
[5]Copri SARL, Coat Izella N°2, 29830 - Ploudalmézeau (France)
* correspondant : M Colin copri@wanadoo.fr

ABSTRACT

Two experiments, Exp. 1 and Exp. 2, were conducted to evaluate the use of Peptasan, a polyherbal mixture of *Saccharum officinarum* and of *Acacia concinna*, in contributing to the control of *Eimeria* in growing rabbits. Exp. 1 was carried out in Mexico, using 40 rabbits weaned at 30 days of age split into 4 groups, supplemented with 0.00; 0.25; 050 and 0.75 kg / ton of Peptasan. Exp. 2 was carried out in France in a deteriorated sanitary context, where 299 rabbits weaned at 34 days of age were divided into 2 groups, with feed supplemented with either 1 kg/ton of Peptasan or control. Feces collection was carried out at 50 days of age in both experiments and also at 70 days in Exp. 2. Weights and slaughtering yields were recorded in both experiments. In Exp. 1, feed intake, feed conversion ratio (FCR) digestibility, dry mater digestibility, meat pH and color parameters were measured. In Exp. 2, mortality was recorded daily and fat characteristics were analyzed. Peptasan decreased the oocystal excretion in both experiments, from 1520 to 240 oocysts / gram in Exp 1 where the level of contamination was low and in Exp. 2, with a high level of contamination, from 33 500 to 25 000 oocysts / gram. This decrease of total oocyst excretion was essentially due to the significant reduction of pathogenic *Eimeria* (*Eimeria magna* + *Eimeria media)* from 27 300 to 18 600 oocysts / gram. In Exp. 2, Peptasan highly significantly decreased mortality in growing rabbits, particularly between 34 and 55 days. Growth performance and slaughtering yields were not significantly modified in either experiment. Peptasan had no effects on feed intake, FCR and dry mater digestibility. Measurements of meat quality (pH, Cholesterol) were not modified by Peptasan except meat luminosity, which was improved, demonstrating that this product had probably no negative effect on iron absorption. Consequently, Peptasan is an interesting solution to contribute to the control of *Eimeria* development in rabbit farming using only natural products.

Key words: *Rabbit, Eimeria, Saccharum officinarum, Acacia Concinna*.

INTRODUCTION

The importance of intestinal infection by *Eimeria* is emphasized in many publications (Licois, 2009) and consequently chemical coccidiostats are often used in the feed to control infection. A previous work has reported the possibility to decrease excretion of *Eimeria* by using only natural products (Colin *et al*, 2013). Peptasan is a mix of physical fractions of *Saccharum officinarum* and of *Acacia concinna.* It has been demonstrated that *Saccharum officinarum* decreased *Eimeria tenella* proliferation in chickens (El Abassy *et al.,* 2003). Saponins of *Acacia concinna* have shown an effect on *Eimeria* development (Pratap et Bhaskar Rao, 1987). Hernandez-Reyes *et al. (*2016) have observed that Peptasan decreased *Eimeria* infection and increased lamb growth. Only one publication deals with the effects of Peptasan in rabbits but lacked a negative control (Kostova *et al.,* 2011). Cheeke *et al.* (1977), have shown a reduction of feed intake of rabbits with alfalfa saponins. Consequently, more research is needed to validate the use of Peptasan for rabbits. Furthermore, saponins can have an effect on lipid quality (Corral *et al.*, 2016). This information does not exist for rabbits.

This publication reports the results of 2 experiments, Exp. 1 carried out in the autonomous university of Mexico and Exp. 2 in the Earl 3L in France (Colin *et al.*, 2013). A portion of these results have already been published (Atkinson *et al*., 2019).

MATERIALS AND METHODS

Treatments and feeds
Exp. 1 included 4 treatments corresponding to different dosages of Peptasan: 0.00; 0.25; 0.50 and 0.75 kg / ton of feed. Exp. 2 has compared a control feed from which the formula was already published (Teillet *et al*., 2011) with a feed supplemented with 1 kg / ton of Peptasan. No antibiotics were used in either experiment.

Animals
In Exp. 1, 40 male rabbits (New Zealand x California) weaned at 30 days of age were housed in individual cages. In Exp. 2, 299 Hycole rabbits weaned at 34 days were housed in collective cages of 5 rabbits / cage.

Measured criteria
Rabbits were weighted at the beginning of the 2 experiments and at the end at 50 days for Exp. 1 and 70 days for Exp. 2. Daily feed intakes were measured in Exp. 1 and mortalities daily monitored in Exp. 2. Samples of feces were collected at 50 days in both experiments and at 70 days in Exp. 2 according to a method already described (Colin *et al.*, 2013; Atkinson *et al.*, 2019). Digestibility of dry matter was measured in Exp. 1 using acid-insoluble ashes as an internal marker (Van Keulen and Young, 1977). Slaughtering yields were measured in both experiments on warm carcasses. In Exp. 1, samples of *Longissimus dorsi* were used to measure pH and color parameters (Volek and Marounek, 2013). In Exp. 2, a sample of perirenal fat was collected to analyze the cholesterol of the fat.

Statistical analysis
The data were analyzed by ANOVA for weights, growths, slaughtering yields and meat pH; after Boolean transformation of the individual data for mortalities (1 for dead rabbit – 0 for alive rabbit) and on logarithms for the number of oocysts.

RESULTS AND DISCUSSION

1. Numeration and identification of the oocysts

Table 1: Number of oocysts in Exp. 1 (thousands / gram)

Peptasan (kg / ton)	0.00	0.25	0.50	0.75
Day 50	1.52	0.34	0.29	0.24

In Exp. 1 with low level of contamination, Peptasan decreased the number of oocysts at 50 days (P = 0.12) (Table 1).

In Exp. 2, the total number of oocysts was systematically and highly significantly lower with Peptasan (P= 0,005), particularly at 50 days (Table 2). The level of the 2 pathogenic *Eimeria* (*E. magna* and *E media*), was systematically and significantly lower with Peptasan (P= 0,014) mainly at 50 days. *E. perforans* excretion was not affected by Peptasan.

Table 2: Number of oocysts per species in the different collects in Exp. 2 (thousands / gram)

Age (days)	50			70		
Species	**Control**	**Peptasan**	**Peptasan % control**	**Control**	**Peptasan**	**Peptasan % control**
Repetition 1						
All	99,7	12,7	12,8	24,0	16,5	68,8
E magna + E media	99,7	12,7	12,8	22,8	12,9	56,6
E perforans	0	0		1,2	3,3	275
Repetition 2						
All	34,0	18,0	52,9	18,0	15,5	86,1
E magna + E media	24,2	13,90	57,6	10,8	2,7	25,1
E perforans	9,8	3,7	37,4	5,6	10,0	178,7
Repetition 3						
All	5,0	1,8	37	58,4	42,9	73,5
E magna + E media	4,4	1,1	24,7	48,4	40,1	82,8
E perforans	0,6	0.8	122,2	7,4	2,8	37,8
Average 3 repetitions						
All	46,2	10,9	23,5	33,5	25,0	74,6
E magna + E media	42,8	9,3	21,6	27,3	18,6	67,9
E perforans	3,5	1,5	42,6	4,7	5,4	113,5

2. Mortality

In Exp. 2, mortality was higher than that generally observed on this farm: 19.4 % *versus* 11.3%. Mortality with Peptasan was significantly lower between 34 and 55 days and highly significantly lower between 34 and 70 days (Table 3).

Table 3: Results of mortality in Exp 2

	Treatments	Control	Peptasan	p-value
Mortality %	34-55 d	13,6	8.6	0,055
	55-70 d	10,2	6.6	0,641
	34-70 d	23,8	15,2	0,004

This mortality decrease can be linked with the lower oocysts excretion with including other actions of fractions of *Saccharum officinarum* and of *Acacia concinna as* immunomodulatory effects (Lo et al, 2005)

3. Weight and growth

In both experiments, Peptasan had no significant effects on weights and growth rates (Table 4). The growth promotion effect observed in lambs (Hernandez-Reyes et al *2016*) was not observed in the rabbits in these trials.

4. Feed intake, FCR and digestibility of dry matter

Peptasan had no significant effects on feed intake, FCR and dry matter digestibility. The negative effects of saponin on feed intake described by Cheeke *et al.*, (1977) with alfalfa saponins were not observed with Peptasan

Table 4: Weight, growth, feed intake and feed efficiency in both experiments

Experimentations	**Exp. 1**						**Exp. 2**			
Peptasan (kg/t)	**0.00**	**0.25**	**0.50**	**0.75**	**RSD**	**P**	**0.00**	**1,00**	**RSD**	**P**
Initial weight (kg)	1.242	1.254	1.127	1.098	115	0.29	0.927	0.957	117	0.33
Final weight (kg)	2.074	2.081	2.052	2.048	66	0.82	2.345	2.298	277	0.28
ADG (g/d)	41.5	41.3	39.8	40.0	6.7	0.49	34.9	33.3	3.7	.28
Feed intake (g/d)	136.7	134.4	138.6	132.7	1.5	0.97	NA (1)			
FCR	3.28	3.24	3.47	3.33	0.11	0.36	NA (1)			
Dry matter digestibility (%)	76.1	77.6	76.7	74.9	0.94	0.66	NA (1)			

(1) Not available

5 Slaughtering yields and meat quality

Peptasan had an no effect on slaughtering yields (Table 5). Neither *Longissimus dorsi* pH nor fat cholesterol content are modified contrary to the observations made by Corral *et al.,* (2013) on layer hen eggs. In Exp. 1, meat luminosity is improved for the highest level of Peptasan possibly indicating that the saponins in Peptasan probably didn't reduce the absorption of iron contrary to the observation reported by Southon *et al.*, 1988 with other kinds of saponins. The other color parameters are not modified.

Table 5: Characteristics of carcass and of the meat in both experiments

Experimentation	**Expe. 1**						**Expe 2**			
Peptasan (Kg/ t)	**0.00**	**0.25**	**0.50**	**0.75**	**RSD**	**P**	**0.00**	**1,00**	**RSD**	**P**
Carcass weight (kg) *	1.125	1.110	1.112	1.093	0.98	0.98	1.988	2.040	0.218	0.92
Slaughtering yields (%) *	51.9	51.4	52.4	51.4	1.59	0.99	62.0	61.9	5.55	0.96
pH *Longissimus dorsi* 24 hours	5.90	5.93	5.97	5.88	0.09	0.97	NA (1)			
Cholesterol (% lipids)	NA (1)						94.6	96.1		
Meat luminosity	43.7	43.0	43.6	46.7	1.10	0.05	NA (1)			

* Exp. 1 : Carcass without head , liver and lung Exp. 2 : Carcass with head, liver and lung

CONCLUSIONS

Peptasan decreased the total excretion of *Eimeria* either in a context of low infestation as well as in a deteriorated sanitary situation, mainly due to the reduction of *Eimeria media* and *E. magna* excretion. Peptasan significantly decreased mortality in the deteriorated sanitary situation and had no effects on

growth, feed intake, dry matter digestibility, or on slaughtering yields and meat quality except for meat luminosity. Consequently, Peptasan is an interesting solution to contribute to the control of *Eimeria* development in rabbit farming using only natural products.

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