INFLUENCE OF METABOLITES DERIVED FROM THE FERMENTATION OF 2 STRAINS OF *LACTOBACILLI* DISTRIBUTED ONLY IN MATERNITY ON THE REPRODUCTIVE AND THE TOTAL PERFORMANCES OF RABBITS (MATERNITY, GROWING FATTENING, SLAUGHTERING)

Malabous A.[1], Robert D.[2], Barotin.L.[2], Prigent A.Y.[3], Van Lissum M. [1], Colin M.[1]

[1]Copri SARL, Coat Izella N°2, 29830 - Ploudalmézeau (France)
[2]STI Biotechnologie, ZA du Coglais, 35460 – Saint-Etienne-en-Cogles (France)
[3]Earl 3L, Coat Izella N°4, 29830 - Ploudalmézeau (France)

*Corresponding author: copri@wanadoo.fr

ABSTRACT

In 2 consecutive reproduction cycles, 160 and 117 does were split between 2 feeds, a Control one and one containing 1.32 kg/t of *Metalac*, a product of fermentation of *Lactobacillus farciminis* CNCM-I-3699 and of *Lactobacillus rhamnosus* CNCM-I-3698. The reproduction performances of these does and the growing – fattening results of their litters were studied, these last ones receiving all a control feed from weaning to 72 days. The prolificacy was higher in the Control group for unknown reasons, but due to the better homogeneity of the "2 days old rabbits", the number rabbits/litter after screening (elimination of the small and sickly rabbits) and the one of weaned rabbits/litter were lightly but statistically significantly higher with the *Metalac* (Respectively + 0.27 rabbit/litter and + 0.15 rabbit/litter). The mortalities before weaning were not modified. The weights at weaning of the rabbits and of the litters were heavier with the *Metalac* (respectively, + 30 g and + 406 g). The *Metalac* distribution to the does before weaning did not modify the mortality of their litter during the growing-fattening period but their weight at 70 days trends to be higher (+ 19 g) (P=0.1). The feed intake and feed conversion ratio were not modified. The slaughter yields were improved highly significantly of + 0.8 point for the rabbits receiving *Metalac* before weaning. Calculating on the base of these results, the intake of 21.6 g of *Metalac* increases the feed intake of 980 g/parturition and the production of live rabbit and of rabbit meat respectively of 840 and 600 g.

Key words: Rabbit, *lactobacillus*, mortality, slaughtering yield

INTRODUCTION

Probiotics are microorganisms showing a beneficial effect on the health of animals ingesting them (Füller, 1989) and have been the subject of numerous studies. Among these, products manufactured from certain strains of different *lactobacilli* appear effective in pigs in terms of preventing diarrhea, reducing the stress effects, modulating immunity and improving overall performance (Hou *et al,* 2015). *Metalac* is a mix of the fermentation products of 2 strains of lactobacilli, *Lactobacillus farciminis* CNCM-I-3699 and *Lactobacillus rhamnosus* CNCM-I-3698 bringing both metabolites and microorganisms and is marketed by STI in France. The efficiency of this product has been demonstrated on the control of *Brachyspira* in pigs, thanks to their aggregative congregative properties (Bernardeau *et al.,* 2007) as well as their barrier and their immunostimulant effects (Bernardeau *et al,* 2001; 2008). However, few studies concern *lactobacilli* in rabbits (Maertens *et al,* 2006), perhaps due to their absence of the rabbit digestive content (Combes *et al,* 2011). Therefore, the present work investigates whether the incorporation of *Metalac* in the does feed improves their performances and the ones of their litter receiving an identical feed without *Metalac*. A part of the preliminary results has already been published (Malabous *et al.,* 2019).

MATERIALS AND METHODS

General presentation

This work studied the effects of the incorporation of *Metalac* into the maternity feed on the performances of rabbits in reproduction and its consequences during the growth of their issued rabbits. It involved 2 successive reproductive cycles representing 160 and 117 does: globally, 127 were affected to the control treatment and 150 to the *Metalac* one. After weaning, the rabbits of both treatments received the same feed without *Metalac*.

Animals

The does corresponding to the *Hyplus* genetic were housed in individual cages under already described conditions (Savietto *et al.,* 2015). For the first cycle, the experimental feeds were distributed 10 days before parturition. Two days after parturition, a screening was carried out to eliminate the small or sickly rabbits. The rabbits were weaned at 35 days. The main part of them was located by 5 in collective cages (Teillet *et al.,* 2011): 1002 corresponding to 199 cages for the control and 978 corresponding to 195 ones for the *Metalac*. They were marketed at 72 days and slaughtered by the Lœul et Piriot slaughterhouse in Thouars (France).

Feeds

The feeds were produced at EARL 3L for maternity and at the SODIVA factory in Rennes (France) for growing - fattening according to the formulas already presented (Malabous *et al.,* 2019). The *Metalac* was incorporated at 1.32 kg/t only in maternity feed. The fattening feed was identical for the 2 treatments. No antibiotics were distributed. The 2 maternity feeds (Control and *Metalac*) were supplemented with a mix of *Uncaria tomentosa* and Eucalyptus essential oil (Colin *et al.,* 2013).

Experimental design

The numbers of litters in maternity were measured at birth (born alive and born dead), 2 days of age (screening time), 8 days of age and weaning enabling the calculation of the percentage of screening at 2 days and of the different mortalities. The rabbits were weighted at weaning. The feed intake of the does was measured by treatment from birth to weaning. During fattening, the mortalities were daily registered, the rabbits weighted at weaning and 70 days. The Economical Feed Conversion Ratio (FCR) was the ratio between the quantity of consumed feed and the total weight gain of rabbits between weaning and sale. The technical FCR was calculated for the sold animals using a method already presented (Teillet *et al.,* 2011). The slaughter yields and the percentage of eliminated rabbits at slaughtering (small, abscess) were measured according to the Lœul and Piriot's method.

Statistical analysis

The number of rabbits/litter, the weights, ADG and slaughtering yields were studied by variance analysis (ANOVA) taking in consideration the repetition effect. The same method was used for the mortalities after Boolean transformation of the data by assigning the value 1 to dead rabbits and the value 0 to live ones (Teillet *et al*, 2011).

RESULTS AND DISCUSSION

The number of rabbits at birth was higher for the control group ($P<0.001$) without clear explanation of this difference (Table 1): in the first repetition and contrary to the second one, the experimental feeds were distributed too late to modify the prolificacy and an effect on embryonic mortality is improbable considering the positive results in pig of the *Metalac* on this criterion (Robert., personal communication). Dead born were not affected by the treatments. The percentage of elimination at screening was lower for the *Metalac* treatment than for the control one ($P<0.001$), leading to a higher number of rabbits/litter in *Metalac* group after screening. According to the farmer, this difference was due to a higher homogeneity and quality of the born rabbits with the *Metalac* treatment but it can't be excluded it was at least partly a consequence of the lower number of rabbits at birth. A low but statistically significantly difference was found for the numbers of rabbits/litter at 8 days

(+ 0.2 rabbits/litter) and at weaning (+ 0.15 rabbits/litter). The mortality before weaning was not affected by the treatments (Table 1). The individual weaning weight was highly significantly higher (P=0.009) with the *Metalac* (+ 30 grams), leading to a total litter weight approximatively 5% higher (+ 406 grams) with the *Metalac* compared to the control (P<0.001). This observation is particularly remarkable because the prolificacy was higher at birth and is probably related to a better assimilation of milk by young rabbits, as observed in piglets at the weaning (Hou *et al.*, 2015).

Table 1: Maternity results

		Control	***Metalac***	**rsd**	**P**
Number of does		127	150		
Number per litter	Total born	12.4	11.9	0.95	<0.001
	Live born	11.9	11.2	0.93	<0.001
	Dead born	0.57	0.62	1.16	0.320
	After screening	9.27	9.54	0.36	<0.001
	8 days	9.26	9.46	0.38	<0.001
	Weaning	8.71	8.86	0.50	0.009
Dead born (%)		4.60	5.20		0.650
Eliminated at screening (%)		21.3	15.0		<0.001
Mortality (%)	Screening - 8 days	0.73	1.00		0.442
	8 days – weaning	5.96	6.33		0.691
	Screening – weaning	6.69	7.33		0.513
Weight at weaning (g)	Weaned rabbits	916	946	83	<0.001
	Litters	7975	8381	809	<0.001
Does feed intake (kg/cycle)		16.275	16.450		

The growing fattening mortality was higher than the ones usually observed in this farm (Minetto *et al.*, 2019) and not significantly modified by the treatments (Table 2). The average sale weight tended to be slightly higher (+ 19 grams) for rabbits issued from the "*Metalac* receiving mothers" (P=0.10). The daily weight gain was not modified by treatment. The both FCR, as well as the quantity of feed consumed per sold rabbit, were not different from one feed to another.

Table 2: Residual effects of maternity treatments on growth and slaughter performances

	Control	***Metalac***	**Residual standard deviation**	**P**
Number of cages (Repetitions)	199	195		
Number of rabbits	1002	978		
Mortality weaning - sale (%)	17.6	18.4		0.692
Weight at sale (g)	2.408	2.427	0.24	0.100
ADG weaning - sale (g/d)	42.1	41.7	6.6	0.230
Economical FCR	3.57	3.52		
Technical FCR	2.82	2.83		
Feed consumption / rabbit sold (kg)	4.20	4.19		
Carcass yield (%)	54.2	55.0	2.4	<0.001
Eliminated rabbits at slaughtering (%)	0.97	1.09		0.982

The carcass yield was higher for the rabbits from "*Metalac* receiving mothers" than for the control ones, indicating an effect of the maternity treatment on this important criterion. This improvement of the slaughtering yield through the does feed is not classical (Pertusa *et al.*, 2014) and needs to be checked. If it is confirmed, it can be put in relationships with the observations of Riberczyk *et al.* (2016) indicating that certain *lactobacilli* reduce the loss of water during chilling. The percentages of eliminated rabbits during the slaughtering were similar for the two treatments.

The Table 3 synthesizes the results in maternity and in growing – fattening period for one parturition: a calculation carried out with these results show that an intake of 21.6 grams of *Metalac* in maternity increases the feed intake/parturition of 980 grams and the production of live rabbit and of rabbit meat

respectively of 840 and 600 grams. In the European context, these difference means a ROI (return on investment) of 2.76 when the farmer sales to the slaughtering plant and of 5.74 when he sales directly to the consumer.

Table 3: Summary of the results in maternity, growing - fattening and slaughtering for one litter

	Control	***Metalac***	**Difference**
Feed intake in maternity (kg)	16.3	16.4	0.18
Feed intake in growing – fattening (kg)	36.8	37.6	0.81
Total feed intake (kg)	53.1	54.1	0.98
Metalac intake (g)	0	21.6	-
Weight of produced live rabbit (kg)	16.5	17.3	0.84
Weight of produced meat rabbit (kg)	8.94	9.53	0.60

CONCLUSIONS

In these experiments, the incorporation of 1.32 kg/t of *Metalac* in maternity feed enables to wean more and heavier rabbits and increases the number of marketable rabbits. The weight at sale is slightly higher for the rabbits issued from "*Metalac* receiving mothers": + 19 g. The slaughter yield of rabbits from "*Metalac* receiving mothers" improved 0.8 point compared to the control ones. Beyond the economic benefit, this observation is one of the first concerning an effect of a maternity feed on the slaughter yield. Summarizing, for one parturition, the dietary intake of 16.5 g of *Metalac* increased the feed intake/parturition of 980 grams and the production of live rabbit and of rabbit meat respectively of 840 and 600 grams, meaning in the European context a ROI of 3.64 when the farmer sales to the slaughtering plant and of 7.56 when he sales directly.

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