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).

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

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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 \textit{Metalac}, a product of fermentation of \textit{Lactobacillus farciminis} CNCM-I-3699 and of \textit{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 \textit{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 \textit{Metalac} (respectively, + 30 g and + 406 g). The \textit{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 \textit{Metalac} before weaning. Calculating on the base of these results, the intake of 21.6 g of \textit{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, \textit{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 \textit{lactobacilli} appear effective in pigs in terms of preventing diarrhea, reducing the stress effects, modulating immunity and improving overall performance (Hou \textit{et al}, 2015). \textit{Metalac} is a mix of the fermentation products of 2 strains of lactobacilli, \textit{Lactobacillus farciminis} CNCM-I-3699 and \textit{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 \textit{Brachyspira} in pigs, thanks to their aggregative congregate properties (Bernardeau \textit{et al}., 2007) as well as their barrier and their immunostimulant effects (Bernardeau \textit{et al}., 2001; 2008). However, few studies concern \textit{lactobacilli} in rabbits (Maertens \textit{et al}, 2006), perhaps due to their absence of the rabbit digestive content (Combes \textit{et al}, 2011). Therefore, the present work investigates whether the incorporation of \textit{Metalac} in the does feed improves their performances and the ones of their litter receiving an identical feed without \textit{Metalac}. A part of the preliminary results has already been published (Malabous \textit{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 pigs at the weaning (Hou et al., 2015).

### Table 1: Maternity results

<table>
<thead>
<tr>
<th></th>
<th>Control</th>
<th>Metalac</th>
<th>rsd</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of does</td>
<td>127</td>
<td>150</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Number per litter</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total born</td>
<td>12.4</td>
<td>11.9</td>
<td>0.95</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Live born</td>
<td>11.9</td>
<td>11.2</td>
<td>0.93</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dead born</td>
<td>0.57</td>
<td>0.62</td>
<td>1.16</td>
<td>0.320</td>
</tr>
<tr>
<td>After screening</td>
<td>9.27</td>
<td>9.54</td>
<td>0.36</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>8 days</td>
<td>9.26</td>
<td>9.46</td>
<td>0.38</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Weaning</td>
<td>8.71</td>
<td>8.86</td>
<td>0.50</td>
<td>0.009</td>
</tr>
<tr>
<td>Dead born (%)</td>
<td>4.60</td>
<td>5.20</td>
<td></td>
<td>0.850</td>
</tr>
<tr>
<td>Eliminated at screening (%)</td>
<td>21.3</td>
<td>15.0</td>
<td></td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mortality (%)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Screening - 8 days</td>
<td>0.73</td>
<td>1.00</td>
<td></td>
<td>0.442</td>
</tr>
<tr>
<td>8 days – weaning</td>
<td>5.96</td>
<td>6.33</td>
<td></td>
<td>0.691</td>
</tr>
<tr>
<td>Screening – weaning</td>
<td>6.69</td>
<td>7.33</td>
<td></td>
<td>0.513</td>
</tr>
<tr>
<td>Weight at weaning (g)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weaned rabbits</td>
<td>916</td>
<td>946</td>
<td>83</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Litters</td>
<td>7975</td>
<td>8381</td>
<td>809</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Does feed intake (kg/cycle)</td>
<td>16.275</td>
<td>16.450</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

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

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

<table>
<thead>
<tr>
<th>Control</th>
<th>Metalac</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feed intake in maternity (kg)</td>
<td>16.3</td>
<td>16.4</td>
</tr>
<tr>
<td>Feed intake in growing – fattening (kg)</td>
<td>36.8</td>
<td>37.6</td>
</tr>
<tr>
<td>Total feed intake (kg)</td>
<td>53.1</td>
<td>54.1</td>
</tr>
<tr>
<td>Metalac intake (g)</td>
<td>0</td>
<td>21.6</td>
</tr>
<tr>
<td>Weight of produced live rabbit (kg)</td>
<td>16.5</td>
<td>17.3</td>
</tr>
<tr>
<td>Weight of produced meat rabbit (kg)</td>
<td>8.94</td>
<td>9.53</td>
</tr>
</tbody>
</table>

**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.

**REFERENCES**


INFLUENCE OF METABOLITES DERIVED FROM THE FERMENTATION OF 2 STRAINS OF LACTOBACILLI DISTRIBUTED IN MATERNITY ON THE REPRODUCTIVE AND GROWTH PERFORMANCE OF RABBITS

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INTRODUCTION

The probiotic effect of *lactobacilli* is the subject of limited number of studies in rabbits.

*Metalac* is a mixture of 2 strains of *lactobacilli*, *Lactobacillus farciminis* and *Lactobacillus rhamnosus* bringing.

No information concerning *Metalac* is available for rabbit.
Influence of metabolites derived from the fermentation of 2 strains of lactobacilli distributed in maternity on the reproductive and growth performance of rabbits (N-27)
Malabous A., Tanguy C., Robert D., Barotin L., Prigent A.Y., Van Lissum M., Colin M.

METHODS

Study of the effects of the incorporation of *Metalac* into the maternity feed on the performance of rabbits in reproduction and on the growth of their issues.

2 successive reproductive cycles involving respectively 173 does and 117 ones.

*Weaning:* 35 days – *Sale of the issues:* 72 days.

Incorporation of *Metalac*: 1.32 kg / ton of the does feed.

**Measured criteria’s**

- Numbers of rabbits/litter at birth, at 8 days of age and at weaning.
- Weight of the rabbits at weaning.
- Slaughtering yield.
RESULTS 1: RESULTS IN MATERNITY

Incorporation of Metalac in does feed

- Higher number of rabbits/litter at birth, at 8 days (P<0.001) and at weaning (P = 0.009).
- No difference on the 8 days – weaning mortality.
- Heavier individual and litter weights at weaning (P<0.001).
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RESULTS 2: RESIDUAL EFFECTS IN GROWING FATTENING

Incorporation of Metalac in does feed

• Average weights at sale slightly higher (+19 grams) for rabbits issued from Metalac receiving mothers (P = 0.10)
• Weaning – sale mortality identical.
• Slaughtering yield higher (+0.8%) for rabbits issued from Metalac receiving mothers (P<0.001).
Influence of metabolites derived from the fermentation of 2 strains of lactobacilli distributed in maternity on the reproductive and growth performance of rabbits (N-27)
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CONCLUSIONS

Consequences of incorporation of 1,32 kg / ton of Metalac in the does feeds

• More weaned rabbits: + 0.15 per litter
• Heavier rabbits at weaning: + 30 grams.
• Heavier litters at weaning: + 406 grams.
• No effects on the 8 days – weaning mortality.

The consequence on the growing- fattening rabbit of this utilization of Metalac in the does feeds

• No effects on the weaning- sale growth but rabbits heavier at sale: +19 grams.
• No effects on the weaning – sale mortality.
• Improvement of the slaughtering yield: +0,8%

✓ First observation of an effect of maternity feed on slaughter yield.
✓ Needs confirmation.
INFLUENCE OF METABOLITES DERIVED FROM THE FERMENTATION OF 2 STRAINS OF LACTOBACILLI DISTRIBUTED IN MATERNITY ON THE REPRODUCTIVE AND GROWTH PERFORMANCE OF RABBITS

THANKS FOR ATTENTION