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IN GROWING RABBITS FROM DIFFERENT GENOTYPES**

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PRODUCTIVE PERFORMANCE AND MORTALITY IN GROWING RABBITS FROM DIFFERENT GENOTYPES

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ABSTRACT

This study evaluated the effect of genotype on productive performance and mortality in growing rabbits. A total of 192 growing rabbits from New Zealand White, Botucatu genetic group and crossbreeds were used for productive performance (32 to 67 days), and a total of 451 kits from 62 kindlings were used for mortality rate. Although there was no difference in feed intake and feed conversion after weaning, Botucatu and crossbred rabbits were heavier at 18, 32 and 67 days of age ($P < 0.05$). These rabbits also showed greater potential for daily weight gain and lower pre-weaning mortality rate. The present study contributes indicating the production of crossbred and Botucatu rabbits, however, additional research evaluating alternatives for reduced pre-weaning mortality rate in Brazilian conditions need to be performed.

Key words: rabbit breeding, growing kit, Botucatu, crossbreed, heterosis

INTRODUCTION

Rabbit breeding for meat production is a strategic activity and is well suited to the molds of economic, social and environmental sustainability. Although it is not widespread in Brazil, the expectations of maintenance and growth are good. Brazil is one of the few American countries that has a meticulous rabbit breeding program, where animals from Botucatu genetic group have been selected for almost 40 years. As a result, these rabbits are able to provide greater productive and reproductive efficiency. The original rabbit group has a high level of inbreeding, and its crossbreeding is indicated (Moura, 2000; Moura, 2017).

There are few studies evaluating different genetic groups in Brazil, and in particular those ones who evaluated the Botucatu genetic group were extremely scarce. Parameters such as muscle fiber development, meat performance, carcass and quality, adaptations to heat stress, behavior and ambience were evaluated, as well as aspects of genetic gain and selection responses. However, no study has evaluated crossbreeding between breeds under standardized conditions yet.

In order to indicate the best genotype for use in Brazilian farms, this study aimed to evaluate the productive performance and mortality rate of New Zealand White (NZW), Botucatu (BOT) and crossbreed (CRO, from NZW x BOT) rabbits during pre and post weaning periods.

MATERIALS AND METHODS

Animals and experimental design

The approval of the Animal Ethics Committee (CEUA-IFMG) was registered under number 01/2018. The investigation was conducted from January 2018 to May 2019, and the average daily temperatures during this experimental period were 19.6 and 30.8°C (minimum and maximum, respectively).

Twenty-seven rabbit does, nine from each genotype (NZW, BOT and CRO) were housed in individually galvanized steel wire cages (60 x 60 cm), with nipple drinkers, semi-automatic feeders and wood footrest. At 158 days of age, rabbits were artificially inseminated (AI). All the NZW does received NZW semen and the others ones received BOT semen. Three days before kindling, the cages were equipped with an externally coupled box-type nest containing grass straw. All the rabbit does were fed with a balanced commercial feed containing 17.7% of CP, 17.2% of ADF and estimated DE of 2450 kcal per kg. The amount of 150g per day was provided for rabbit does without kits or until 20th day of pregnancy, and *ad libitum* from the final third of pregnancy (day 21) and also during all lactation period. A total of 62 kindlings from three first cycles were used. Depending on the availability of new born kits, litter size was standardized at eight kits per doe, removing or adding kits. The established interval between kindlings was 42 days, where the rabbit does received AI 11 days after kindling, except for primiparous does, that were inseminated only after the first weaning, which occurred at 32 days of lactation.

After weaning, the growing kits were housed in cages (100x70cm), enriched with aluminum can, PVC tube and second level platform, totalizing eight animals per cage, as a repetition. Live weight was measured at 18 (LW18), 32 (LW32) and 67 (LW67) days of age. Daily weight gain (DWG32-67), daily feed intake (DFI32-67) and feed conversion (FC32-67) was measured at 32 and 67 days. The age of 67 days was suggested by Bianospino et al. (2006).

Statistical Analysis

To assess mortality during the lactation period, an initial number of 451 kits was considered. In order to evaluate the productive performance after weaning, a total of 192 growing rabbits from three genotypes (NZW, BOT and CRO – 64 kits per genotype) was used, considering two blocks (kits from primiparous or multiparous does) and 24 experimental units (eight repetitions per treatment). The reproductive cycle order was considered for LW18 and LW32. Analyses were conducted by Statgrafics Centurion statistical program and ANOVA was performed. Means were compared by Tukey test at 5% of probability. A chi-square test was used for mortality.

RESULTS AND DISCUSSION

Botucatu kits were heavier at 18 and 32 days of age (Table 01). Considering the interaction for LW18 and LW32, it was strongly influenced by BOT does from the third cycle. Considering that only three BOT does reached the third cycle, the statistical analysis for these parameters was revised, evaluating only the first two cycles. This procedure clarified the facts that BOT and CRO provide heavier kits (461.0 vs 498.9 vs 505.8g for NZW, BOT and CRO, respectively). There was no interaction between cycle and genotype.

Live weight at 67 days was heavier in BOT and CRO rabbits (Table 02), which is mainly due to the higher LW32. Advantages in the final weight of crossbred animals was also verified by Jaouzi et al. (2004) and Bianospino et al. (2006). According to both authors, it occurs due to the larger hybrid vigor from crossbred animals (heterosis).

Table 1- Productive performance of growing rabbits from New Zealand White, Botucatu and crossbreed genotypes from three reproductive cycles (all kits from 62 kindlings).

Traits (g)	Genotypes								
	NZW	<i>se</i>	BOT	<i>se</i>	CRO*	<i>se</i>	Pg	Pc	PgxPc
LW18	273,9a	9,72	323,5b	12,5	292,3a	8,09	0,0115	0,0000	0,0211
LW32	645,5a	22,03	829,0c	28,36	730,8b	18,32	0,0000	0,0275	0,0002

*The crossbreed group present blood degree of $\frac{3}{4}$ Botucatu and $\frac{1}{4}$ NZW.

LW18: live weight at 18 days of age (g), LW32: live weight at 32 days of age (g). NZW: New Zealand White breed, BOT: Botucatu genetic group and CRO: crossbreed (NZW x BOT) rabbits, *se*: standart error. Pg: probability between groups, Pc: probability between cycles, PgxPc: interaction between groups and cycles.

In our study, rabbits also showed slight advantage for DWG 32-67. Kits from primiparous does were heavier than those from multiparous does. These findings don't agree with Moura et al. (2003) and Machado et al. (2019). No significant differences were observed for DFI 32-67 and FC 32-67 between the three genotypes. It is necessary to emphasize that weight at weaning depends on the rearing environment, especially the litter size, which has an inverse relationship (Poigner et al., 2000).

Table 2- Productive performance of kits of New Zealand White, Botucatu and Crossbred genotypes, from primiparous or multiparous rabbit does, during the growing period (32 to 67 days – 192 kits).

Traits (g)	Genotypes								
	NZW	<i>se</i>	BOT	<i>se</i>	CRO*	<i>se</i>	Pg	Po	PgxPo
LW32	610,2a	19,75	698,0b	24,63	719,0b	19,75	0,0026	0,0341	0,5908
LW67	1940,5a	30,92	2083,1b	38,56	2156,3b	30,92	0,0003	0,0079	0,0096
DWG 32-67	38,00a	0,88	39,57ab	1,10	41,07b	0,88	0,0724	0,1452	0,1681
DFI 32-67	119,7	3,70	118,0	4,62	125,1	3,70	0,4348	0,3329	0,6580
FC 32-67	3,15	0,08	2,99	0,10	3,05	0,08	0,4694	0,9287	0,8503

*The crossbreed group present blood degree of $\frac{3}{4}$ Botucatu and $\frac{1}{4}$ NZW.

LW32: live weight at 32 days of age (g), LW67: live weight at 67 days of age (g), DWG 32-67: daily weight gain (g), DFI 32-67: daily feed intake (g), FC 32-67: feed conversion. NZW: New Zealand White breed, BOT: Botucatu genetic group and CRO: crossbreed (NZW x BOT) rabbits, *se*: standart error. Pg: probability between groups, Po: probability between origin of kits (primiparous vs multiparous), PgxPo: interaction between groups and origin.

Rabbit feed intake varies widely according to different ambient and management conditions. The high environmental temperature from January to March had a direct impact on the DFI 32-67, reaching an average value of 120.9g per day. This value is low when compared to Bianospino et al. (2006) and Szendro et al. (2015) (129.3 and 139.5 per day, respectively). Feed conversion is as important as feed intake capacity. The mean FC (3.06) is better when compared to the values found by Bianospino et al. (2006) and Szendro et al. (2015), but worse than Jaouzi et al. (2004). It occurs mainly due to the different weaning ages and slaughter, in addition to different experimental conditions. However, our results are very similar to that reported by Trocino et al. (2015) using European rabbits (Hyplus genotype).

The mortality of lactating kits was influenced by the genotype (Table 03), where the NZW presented the worst result ($P < 0.05$). Higher mortality was observed from birth to 18 days of lactation, which is a critical period. The average mortality rate of 24.6% would have a major economic impact on farmers. This high mortality is one of the most problems in Brazilian rabbit breeding, and up to 20% is framing at an acceptable level (Machado, 2018). It is necessary to intensify the search for solutions that minimize pre-weaning mortality. During the fattening phase, there was no rabbit mortality. This suggests that unlike in Europe where there is a high incidence of enteropathy, in Brazil this period does not present related problems.

Table 3- Mortality rate of growing kits from three genotypes, during lactation.

Period (days of lactation)	Genotypes			
	NZW	BOT	CRO*	P
kindling to 18	28,5b	16,8a	17,8a	0,0229
18 to 32	5,1	4,1	4,0	0,5810

*The crossbreed group present blood degree of $\frac{3}{4}$ Botucatu and $\frac{1}{4}$ NZW.

NZW: New Zealand White breed, BOT: Botucatu genetic group and CRO: crossbreed (NZW x BOT) rabbits. P: probability between groups according with chi-square test.

CONCLUSIONS

According to higher live weight, BOT and CRO are indicated for the production of Brazilian rabbit farms. New studies evaluating alternatives for reducing pre-weaning mortality in Brazilian conditions need to be performed.

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Productive performance and mortality in growing rabbits from different genotypes

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Context: Botucatu are the only rabbit genetic group developed in Brazilian conditions and its use by farmers need to be stimulated. The advantages of crossbred kits need to be measured.

The question: How is the mortality rate and performance of rabbit kits from different genotypes?

Methods : 9 Botucatu, 9 NZW and 9 crossbreeds does, during three reproductive cycles, provided 451 kits from 62 kindlings. NZW does received NZW semen and the others received Botucatu semen, using artificial insemination. 192 weaned kits were housed in cages (100x70cm), enriched with aluminum can, PVC tube and second level platform, eight animals per cage and eight repetitions.

Results : The tables show the performance and mortality of kits

BOT and CROS

PRE-WEANING KITS: 461.0 vs 498.9 vs 505.8g (P<0.05)

Traits (g)	Genotypes								
	NZW	se	BOT	se	CRO*	se	Pg	Po	PgxPo
LW32	610,2a	19,75	698,0b	24,63	719,0b	19,75	0,0026	0,0341	0,5908
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FC 32-67	3,15	0,08	2,99	0,10	3,05	0,08	0,4694	0,9287	0,8503

Period (days of lactation)	Genotypes			
	NZW	BOT	CRO*	P
kindling to 18	28,5b	16,8a	17,8a	0,0229
18 to 32	5,1	4,1	4,0	0,5810

In general

- NZW: lighter kits and higher mortality rate
- Botucatu and crossbred: heavier kits and smaller mortality rate

Take home message : Brazilian rabbit breeding needs to use the Botucatu genotype to improve the growing performance