



Evaluation of reproduction performance of Hyla rabbits in hot and humid region in Benin

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Abstract

A study was carried out to evaluate the reproductive performance of Hyla rabbits from one generation to another under tropical climate in Benin. Thirty rabbit does were imported from France (group 1) were compared with 30 rabbit does born in Benin (group 2) at their first generation. The does were housed in individual cages and were fed pellet diet. They were mated naturally 48 hours after an injection of Pregnant Mare Serum Gonadotrophin (PMSG) to stimulate follicles' maturity and ovulation. Significant differences in fertility and abortion were recorded between does groups. Average pregnancy duration, litter size, kids rabbit weight at birth and at weaning were similar in both groups. The stillbirth rate and kids' rabbit mortality during lactation were significantly higher in group 1 than group 2. The daily feed intake of empty does was significantly higher in group 2, whereas it was similar in both groups during pregnancy. The study indicated that hot and humid climate affected significantly some reproduction traits of Hyla does.

Key words: Adaptability, Doe, Hyla breed, Rabbit

Introduction

Meat production is lower than its demand in Benin. In 2008, the imports of all categories of meats in carcass were about 82 986 tons (Gounou and Didavi, 2009). To overcome such deficit, the value links of different meats can be developed. In that perspective, rabbit meat is targeted among other meats because, 64% of Beninese had consumed at least once rabbit meat, and 95% of them appreciated it positively (Kpodékon and Tomagnimena, 1992). Additionally, feeding resources for rabbit are available in hot and humid region of Benin.

Unfortunately, the productivity of "local" breeds introduced many years ago is low, increasing the production cost, although rabbit seems adapted to hot and dry summers (Lebas, 2002). In semi and intensive systems, the rearing of more productive rabbit breeds could be a suitable path to improve the productivity and to reduce the production cost. Hyla rabbit is reported to be a productive breed that is used in many cross-breeding programs (Hamouda et al., 1990). It was introduced at experimental level in hot and humid

region in Benin. The main cause for abnormal maternal and sexual behavior of rabbits is the hot climate (Verga, 1992). Although, in rabbitry, does were fertilized under conditions of 34°C ambient temperature and had natural parturition at 36°C ambient temperature (Yamani and Farghally, 1988); the optimum mating and kindling took place at 26-30°C (Xu et al., 1992). Ghosh et al. (2008) reported that winter was the most favorable season for kindling, whereas summer appeared to be the most unfavorable season in terms of litter weight and size at weaning. Mortality of rabbit is the most obvious sign of heat stress; but, poor weight gain, impaired feed conversion, increased disease incidence, decreased fertility, reduced reproductive efficiency and other conditions may also result and adversely affect rabbitry economics (Yamani and Farghally, 1988). It is therefore suitable to study the adaptability of all rabbit breeds introduced in another climatic condition.

In an endeavour to evaluate the reproduction performances of Hyla rabbits in relation with their adaptability from one generation to another, an experiment was carried out in hot and humid climate in Benin.

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Materials and Methods

A total of 15 Hyla male (16 weeks old) rabbits and 30 Hyla does (14 weeks old) imported from France (group 1), and 30 does that were born in Benin (group 2) at the first generation from the imported rabbits were used in the experiment. Both sexes of reproductive rabbits were imported from a pure line of Hyla breed in France. At the start of the experiment imported does in group 1 were 34 weeks-old and had two parturitions. Does that were born in Benin in group 2 were 22 weeks-old and were nulliparous. To stimulate follicles' maturity and ovulation, all the experimental does were injected with Pregnant Mare Serum Gonadotrophin (PMSG, GONASER® hormone from Hipra Laboratories). The injection was subcutaneous in the scruff of the neck and each doe received 25 IU of PMSG diluted in 0.25 ml of saline solution (Glucosalina Grifols® from Hipra Laboratories). Both doe groups were mated naturally 48 hours after the injection of PMSG, using only imported males and avoiding the consanguinity in does in group 2.

The experimental period covered 71 days, including 2 days of follicle stimulation, 28 to 34 days of pregnancy-parturition and 35 days of lactation. Rabbit kids were weaned at 35 days of age. The housing and feeding were similar in both does groups.

The does and male rabbits were housed similarly in individual cages (88 x 56 x 40 cm³) having feeder and water teat. All the cages were in the same house. During the experiment, the ambient temperature ranged between 24.4 and 30.8°C and the relative humidity from 65 to 92% in the house.

The does and male rabbits were fed *ad libitum* on a pellet feed. The nutritional composition of feed was 88% dry matter, 16% crude fiber, 2500 kcal/kg of digestible energy, 17% crude proteins, 0.75% lysine, 3% crude fat, 1.2% calcium and 0.7% total phosphate.

Statistical analysis

Data were analyzed using general linear model (GLM) in SAS Institute Inc. (2004), version 9.1.2. The performances of both does groups were compared using each cage as repetition. Analyses were performed according to the model:

$$Y_i = \mu + D_i + \varepsilon_i \quad \text{with:}$$

Y_i = Observation for dependent variables;

μ = Overall mean;

D_i = Fixed effect of does rabbit group;

ε_i = Residual error.

The significant effect of does group was reported, when the P-value from the comparison is less than 5% (P<0.05).

Results

The fertility rate evaluated 14 days after mating was significantly higher (P<0.05) in group 1 (imported does) than group 2. A significant difference was recorded between groups (P<0.05) in abortion that was null in group 2 versus 12.5 ± 1.8% in group 1 (Table 1). The pregnancy duration, litter size and the weight of kids rabbit at birth and weaning (Table 1) were similar in both groups (P>0.05). However, the stillbirth rate and the mortality rate of kids during lactation were significantly lower (P<0.05) in group 2 than in group 1 (Table 1).

The average body weight of weaned rabbit kids was 12% higher in group 1 than in group 2 (Table 1) but the difference was not significant (P>0.05). Thus, during lactation the daily weight gain of rabbit kids was better in group 1 than in group 2.

The daily feed intake of empty group 2 does was significantly higher (P<0.05) than that of group 1 does (Table 2).

Table 1: Reproduction traits of does Hyla rabbits imported (Group 1) or born in Benin (Group 2) from pregnancy to kids weaning

	Group 1	Group 2
Fertility rate (%)	53.3±0.52 ^a	73.3±0.46 ^b
Abortion rate (%)	12.5±1.80 ^a	0.00 ^b
Pregnancy duration (days)	31.0±2.16	31.8±1.08
Litter size (kids)	7.29±3.30	6.45±2.07
Still birth (%)	29.6±2.43 ^a	17.7±1.18 ^b
Kids mortality in lactation (%)	25.0±2.50 ^a	14.0±1.40 ^b
Kids weight at birth (g)	55.6±10.7	54.4±12.0
Kids weight at weaning (g)	717.4±152	638.2±213
Kids weight gain in lactation (g/day)	18.9 ± 1.2	16.8 ± 0.95

^{a,b}Means with unlike superscripts in the same row differ significantly (P<0.05)

Table 2: Daily feed intake (g) of empty and pregnant does Hyla rabbit imported (Group 1) or born in Benin (Group 2)

	Empty does	Pregnant does
Group 1	153.9±13.2 ^a	176.6±24.5
Group 2	1688±14.7 ^b	168.0±14.8

^{a,b}Means with unlike superscripts in the same column differ significantly (P<0.05)

Discussion

The ambient temperatures (24.24 °C to 31.18 °C) recorded in the experimental farm for the 10 last years were higher than the average summer temperature (22 °C) in France (Jones et al., 1999) from where does rabbits were imported. In addition, the relative humidity (65 to 92%) was high in that area. In Hyla rabbits' house, Salaun (2008) suggested a temperature between 15 to 24°C, whereas for Xu et al. (1992), optimum mating and kindling took place at 26-30°C in rabbitry.

According to Djago et al. (2010), high temperature negatively affected the reproductive traits of rabbits. Yamani and Farghally (1988) found a decrease in feed intake, litter weight, litter size and ability to live. The climatic conditions of Benin were therefore difficult for Hyla rabbit. However, the difference of age and parity number of rabbit does could be another reason for the differences between groups (Belabbas et al., 2011), because there is a positive relationship between litter traits and advanced parity (Hassan, 1993; Karikari et al., 2011).

The pregnancy duration, litter size at birth, kids' weights at birth and at weaning were similar in both groups. These variables did not depend on the short acclimation period of does involved in this experience. The litter sizes recorded were lower than 9.49 reported by Vaclavovsky et al. (2000) and 8.50 recorded at first generation with Hyla rabbit in Tunisia (Hamadou et al., 1990), but higher than 4 to 6 reported in Beninese local breed (Kpodékon et al., 2006), 4.14 ± 0.22 in Sudanese rabbit (Elamin and Yousif, 2011) and 3.95 to 5.35 in crossbreed in Ghana (Karikari et al., 2011). The litter sizes in this study were also lower than 8.3 reported as average in different rabbit breeds in Australia (Prayaga and Eady, 2002), but close to 6.30 recorded with New Zealand White rabbit in USA (Medellin and Lukefahr, 2001).

The weights of kids at birth and weaning were not significantly different between groups. However, weaned kids from imported does (group 1) tended to be heavier than kids from does born in Benin (717.4 ± 152 g versus 638.2 ± 213 g). This could be due to the parity number, does in group 2 being nulliparous, whereas those in group 1 were at their third parturition. The average weights of kids at birth were lower than 58.1 g and 60.2 to 62.07 g reported respectively by Prayaga and Eady (2002) in Australia and Karikari et al. (2011) in Ghana. However, these weights were higher than reported with Sudanese rabbits (Elamin and Yousif, 2011). The weaned kids' weights were also higher than recorded at 35 days-old in Hyla rabbitry in Tunisia (Hamadou et al., 1990) and than those reported by Karikari et al. (2011) in Ghana.

The high stillbirth rate and mortality of kids during lactation reduced remarkably the survivability of kids in both groups. The mortality rates in group 2 represented about 60% and 56% of those in group 1 respectively, at birth and lactation phases. The survivability of rabbit kids during lactation depends among others on the litter size and kids weight which were similar in both groups of does. The significant decrease of mortality in group 2 compared to group 1 confirms in certain instance an acclimation of rabbit does born in Benin; because, mortality is reported to be the most obvious sign of heat stress (Yamani and Farghally, 1988). In both groups, the mortality of kids during lactation was higher than

reported in Nigeria (Iyeghe-Erakpotobor et al., 2008). The high mortality indicates a low lactation trait of Hyla rabbit does in the climatic conditions of Benin.

Feed intake and its efficiency are the most important factors affected by climatic conditions. The cooler period during the night is suggested to be the feeding time, not only for the growth performance, but also for better reproductive efficiency of rabbit as well as of poultry (INRA, 1989). In this study, the daily feed intake of empty does was significantly higher in group 2 than group 1. This can be due to the continuation of their growth and to their climatic adaptability. During the pregnancy, the similarity of feed intake might be in relation with the similarity of litter size in both groups, although feed intake increases with the parturition number (Karikari et al., 2011). The daily feed intake values recorded were higher than recommended for empty does by Fielding (1993), recorded in Nigeria with pregnant Nulliparous crossbred (Iyeghe-Erakpotobor et al., 2008) and pregnant crossbred does in Ghana (Karikari et al., 2011). According to Yamani and Farghally (1988), the feed intake, appetite, daily gain and feed conversion improve in the lower ambient temperature (20-26°C) than in higher (26-31°C).

Conclusion

This study showed that on average, litter size and the weight of Hyla rabbit kids at birth and weaning were interesting. However, fertility of does, stillbirth and the mortality rate of kids during lactation need to be improved from one generation to another before the extension of Hyla rabbit in hot and humid region of Benin.

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References

- Belabbas, R., AinBaziz, H., Ilès, I., Zenia, S., Boumahdi, Z., Boulbina, I. and Temim, S. 2011. Etude de la prolificité et de ses principales composantes biologiques chez la lapine de population locale algérienne (*Oryctolagus cuniculus*). *Livestock Research for Rural Development*, 23 (3): Article # 61.
- Djago, Y., Kpodékon, M. and Lebas, F. 2010. Guide pratique de l'éleveur de lapins sous les tropiques. CECURI, 2nd (Ed.), Benin.
- Elamin, K.M. and Yousif, I.A. 2011. Evaluation of litter traits in Sudanese rabbits. *Livestock Research for Rural Development*, 23 (9): Article # 197.
- Fielding D. 1993. Le lapin. Maisonneuve et Larose Edition, Paris.
- Ghosh, S.K., Das, A., Bujarbaruah, K.M., Dhiman, K.R. and Singh, N.P. 2008. Effects of breed and

- season on rabbit production under subtropical climate. *World Rabbit Science*, 16: 29–33.
- Gounou, E. and Didavi, E. 2009. Concertation technique sur les bilans céréaliers et alimentaires dans les pays du CILSS et en Afrique de l'Ouest. Proceeding of workshop. Accra, Ghana 4 to 6 Novembre 2009. Country Report. Benin.
- Hamouda, M., Salwa, K. and El-Gaied, J. 1990. Crossing of local rabbits with the Hyla strain: growth and reproductive performance in the first generation. *Options Méditerranéennes, Série A*, 8: 103-108.
- INRA, 1989. Alimentation des animaux monogastriques: Porc, lapin, volailles. 2nd (Ed.), Institut National des Recherche Agronomiques. France. P :282.
- Iyeghe-Erakpotobor, G.T., Adeosun, Y.G., Sekoni, A.A. and Esievo, L.O. 2008. Reproductive performance of rabbit does on concentrate to forage (*Stylosanthes hamata*) combinations. *Livestock Research for Rural Development*, 20(11), Article # 178.
- Jones, P.D., New, M., Parker, D.E., Martin, S. and Rigor, I.G. 1999. Surface air temperature and its changes over the past 150 years. *Reviews of Geophysics*, 37(2): 173–199.
- Karikari, P.K., Darkoh, G. and Deku, G. 2011. Evaluation of millet residue meal based diets as feed for the domestic rabbit (*Oryctolagus cuniculus*). *Research Opinions in Animal and Veterinary Sciences*, 1(3): 144-149.
- Kpodékon, M. and Tomagnimena, P. 1992. Acceptabilité de la viande de lapin en République du Bénin. Bulletin d'Information du Réseau de Recherche et Développement Cunicole en Afrique. 1 : 15-21.
- Lebas, F. 2002. La biologie du lapin. 2nd Edition Cuniculture Info. France.
- Medellin, M.F. and Lukefahr, S.D. 2001. Breed and heterotic effects on postweaning traits in Altex and New Zealand White straightbred and crossbred rabbits. *Journal of Animal Science*, 79:1173-1178.
- Prayaga, K.C. and Eady, S.J. 2002. Performance of purebred and crossbred rabbits in Australia: doe reproductive and pre-weaning litter traits. *Australian Journal of Agricultural Resources*, 53:993-1001.
- Salaun, J-M. 2008. Guide d'élevage HYLA. Germillan Edition (Gosne), P:30.
- SAS Institute Inc. 2004. Qualification Tools User's Guide. Statistic Analysis System Procedure. Version 9.1.2. (SAS Institute Inc. Cary NC, USA).
- Vaclavovsky, J., Kernerova, N. and Lorek, M.O. 2000. The performance traits in broiler rabbits of Hyla combination. *Series for Animal Sciences*. 17(2): 155-163.
- Verga, M. 1992. Some characteristics of rabbits behaviour and their relationship with husbandry systems. *Journal of Applied Rabbit Resources*, 15: 55-63.
- Xu, L., Uang, G., Chen, Z., Huang, S., Chen, J., Jin, S. and Ye, Y. 1992. Studies on integrative measures for raising the reproductive ability of the domestic rabbits during hot season. *Journal of Applied Rabbit Resources*, 15: 569-574.
- Yamani, K.A. and Farghally, H.M. 1988. Adaptability of rabbits to the hot climate. Proceeding of 4th World Congress, *World Rabbit Sciences Association*, 10-14 October, Budapest, Hungary. Pp: 65-69.