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GROWTH PERFORMANCE UNTIL WEANING OF YOUNG RABBITS BORN IN FRANCE AND FOSTERED IN BENIN AT 3 DAYS OF AGE, IN COMPARISON WITH LOCAL RABBITS *

KPODEKON M.[1], ADEHAN R.[1], DJAGO A.Y.[2], LEBAS F.[3], COUDERT P.[4]

Université Nationale du Benin, Laboratoire de Recherche en Chimie et Biologie Appliquees, Unite de Recherches Cunicole et Cavicole, BP 2009 COTONOU, Benin
[2] College Polytechnique Universitaire, CECURI, BP 2009 COTONOU, Benin
[3] I N R A, Station de Recherche Cunicole, BP 27, 31326 CASTANET-TOLOSAN, France
[4] I N R A, Station de Pathologie Aviaire et de Parasitologie. Pathologie du Lapin, 37380 NOUZILLY, France

ABSTRACT : A total of 80 two-day-old suckling rabbits of a selected New Zealand White rabbit strain imported from a temperate country (France) were suckled in a tropical country (Benin) by foster does of the local population. The growth performance of the imported rabbits and of 81 native rabbits suckled by the same does was compared. No morbidity was observed in both groups. Growth rate was identical in both groups up to 21 days i.e. the end of the exclusive milk feeding : 10.2 and 10.5 g/day for imported and native rabbits respectively. During the last period before weaning (21 to 31 days) the group of imported sucklings had a lower growth rate (13.0 vs 17.1 g/day). This period corresponds to the beginning of solid food consumption. A genetic adaptation of the local rabbits to the local feed and/or climate, or, more probably, an effect of the early chemosensory experience (during both gestation and first suckling) of the imported strain are discussed.

RESUME : Performances de croissance jusqu'au sevrage de lapereaux nés en France et élevés au Benin a partir de l'âge de 3 jours, en comparaison avec des lapins de population locale.
Un total de 80 lapereaux de 2 jours provenant d'une souche de lapins Neo Zélandais Blancs sélectionnée dans un pays tempéré (France), ont été transporté et adopté dans un pays a climat tropical (Benin) par des mères d'une population locale. La croissance des lapereaux importé et des lapereaux autochtones a été comparée. Aucune morbidité particulière n'a été observée dans aucun des deux groupes. La croissance fut identique pour les deux groupes jusqu'a (l'âge de 21 jours, soit jusqu'a la fin de l'alimentation exclusivement lactée des lapereaux : 10,2 et 10,5 g/jour pour les lapereaux importés et locaux respectivement. Entre 21 et 31 jours (sevrage) les lapereaux importés ont eu une croissance plus faible : 13,0 contre 17,1 g/jour pour les lapereaux nés sur place. Cette période correspond au début normal de la consommation d'aliment solide. Deux hypothèses explicatives sont évoquées par les auteurs : soit une adaptation génétique de la souche locale a l'alimentation locale et/ou au climat, soit plus probablement une différence entre les lapereaux import& et les lapereaux locaux dans l'expérience chémo-sensorielle initiale acquise pendant la vie *in utero* et lors de la première tétée.

INTRODUCTION

Most of the reports concerning rabbit raising in hot climates reveal lower performances than in European countries (OWEN,. 1978; SAMOGGIA *et al.*, 1987 ; EHIOBU *et al.*, 1997). At least four main reasons could explain these differences : the climate, the local conditions of breeding (equipment, professional knowledge, ...), the strains and the quality of feed.

In order to analyse the relative contribution of strains, a general study was planed in Benin. The first step of the study, presented here, was the introduction in Benin of New Zealand Rabbits (NZW) selected in France, for a comparison with rabbits from local population. Pure-bred NZW rabbits were introduced in Benin as young as possible *i.e.* few days after birth. The objective was to obtain at weaning, local and imported rabbits well adapted to the same climatic, raising and feeding conditions. The experiment was conducted in the experimental facilities of the *Centre CUnicole de Recherche et d 'Information (CECURI)* in Benin, under tropical climate (KPODEKON and COUDERT, 1993).

* A part of these results was presented during the 6th World Rabbit Congress in Toulouse (9-12 July 1996).

MATERIAL AND METHODS

Animals

- CECURI : the African rabbit strain was initially constituted by collecting females and males in different regions of Benin. Later, some new genes were introduced in this strain by the means of artificial insemination with sperm from a NZW strain raised in Toulouse. The experiment reported in the present paper occurred three years after the last introduction of external genetic resources, *i.e.* with female of the second or third generation.
- TOULOUSE: the rabbit strain (A-1077 issued from NZW rabbits) was selected at the *Institut National de la Recherche Agronomique* (INRA) Centre of Toulouse (France) for reproduction traits (ROCHAMBEAU *et al.*, 1994)

Breeding managment

- **CECURI :** the breeding unit is open-sided, and equipped with 80 wire mesh cages in flat deck. Each cage has a metal feeder, a nest-box and an automatic watering system. The weanlings are bred in a separate room. Hygienic prescriptions are strictly respected **(KPODEKON,.** 1988) and prophylactic treatments are regularly used against coccidia **(ADEHAN** *et al.,* 1992) and intestinal worms. The does are mated 10 days after kindling and the young rabbits weaned at 30 - 31 days of age.
- **TOULOUSE:** the general engineering and management are quite similar but the rooms are closed and air conditioned and the access are strictly controlled.

Table 1: Ingredients and gross composition of the coarse meal concentrate employed in the CECURI.

List of ingredients		Chemical composition (% as fed)	
Maize	14.0 %	Dry matter	94.2
Wheat bran	50.0 %	Crude proteins	17.6
Brewer's grains	30.0 %	Crude fibre	9.5
Soya meal	4.0 %	ADF	11.5
Oysters shells	1.6 %	NDF	33.2
Salt	0.4 %	Ether extract	4.2

Feeding conditions

- **CECURI:** animals were fed *ad libitum* with coarsely ground concentrate presented as meal (table 1) and fresh forage renewed every day (palm tree leaves : *Elaeis guineensis).*
- **TOULOUSE :** Rabbit does received *ad libitum* a commercial balanced pelleted feed (table 2).

Experimental design

- Mothers of the experimental young rabbits were mated (TouLousE) or inseminated **(CECURI)** on the same day (Nov. 16th, 1994). Bucks employed for mating or insemination belonged to the same genetic strain than the corresponding does.
- In TOULOUSE, the suckling was controlled (nest-boxes were opened only 15 minutes in the early morning). A total of 80 newborns were selected from 17 litters on day 2 after birth, identified with a mark in the ear and then shipped by plane to the **CECURI.** The main criteria of kits selection were individual weight (in the first **half** of weight distribution within litter), size of the litter (7 to 10 kits born alive) and a sufficient milk intake the day of selection (according to abdominal distension).
- In the **CECURI** the litters were equalised at birth to 6 newborns and the suckling was also controlled.
- When the European newborns arrived in Benin on the early morning of their third day, three native sucklings were eliminated from 27 litters and replaced by **TOULOUSE** imported kits. The nest-boxes were opened two hours after the mixing with the native newborns and the effective suckling was controlled. The interval between the last suckling in Toulouse and the first suckling in **CECURI** was exactly 24 hours, *i.e.* the normal interval between two consecutive sucklings for the rabbit. The corresponding suckling interval was also 24 h for local kits.

The 81 **CECURI** sucklings were individually identified on day 6 and all rabbits were individually weighed at the ages of 6, 21 and 31 days.

Statistical analysis

The weights and average daily gains were studied according to a variance analysis with 2 fixed factors (kits origin : 2 levels, and fostering doe : 27 levels) with interaction, using the GLM procedure of the SAS software (SAS, 1988). Mortality rates were compared with a chi-square test.

RESULTS AND DISCUSSION

Table 2: Ingredients and gross composition of the complete pelleted feed employed in TOULOUSE

List of ingredients		Chemical composition (% as fed)	
Wheat	10.00 %	Dry matter	87.8
Barley	1.65 %		
Wheat bran	21.45 %	Crude proteins	16.2
Alfalfa dehydrated	34.98 %	Crude fibre	15.1
Sunflower meal	12.10 %	ADF	18.0
Spring smooth peas	4.00 %	NDF	31.8
Sunflower seeds	3.50 %	Ether extract	4.0
Wheat straw	4.80 %	Minerals	9.0
Cane molasses	5.00 %	Calcium	1.6
Minerals & Vitamins	2.52 %	Phosphorus	0.6

Morbidity

No disease occurred on does during this period. This situation is usual in CECURI during the whole dry season (November to April). Controls of coccidia were regularly done on faecal samples. The oocyst outputs were always low and no treatment was undergone.

Two sucklings from **TOULOUSE** displayed a diarrhoea when 13 days old. They were individually treated with sulphonamide and recovered

Table 3 Growth of suckling rabbits in tropical climate: comparison of native sucklings with sucklings imported from a temperate country at two days of age.

Type of strain	Initial No	Weight (g) at 6 days	Weight (g) at 21 days	Weight (g) at 31 days	Weight gain (g/day) from days 6 to 21	Weight gain (g/day) from days 21 to 31
Local (Cecuri)	n=81	73.6	231.5	408.2	10.51	17.10
Imported (Toulouse)	n=80	79.9	233.8	365.4	10.20	13.04
Residual coef. of Variation	*(%)*	*15.5*	*11.2*	*12.8*	*14.5*	*24.9*
Probability		P<0.001	NS	P<0.001	NS	P<0.001

rapidly. Two others died when 17 days old. On the same day one rabbit from CECURI died also.

During the same time, mortality of the young of the same litters than the TOULOUSE rabbits, but reared by their own mother in France, was 11.5% (litters with 5 or more remaining rabbits, average 7.42; TUDELA **and** ROCHAMBEAU, 1997, personnal communication). The lower mortality in the CECURI rabbitry (P=0.02) and the low absolute value (2.5%) indicate that the sanitary status was good.

Weight and weight gain (Table 3)

Significant differences were observed in young performance according to the rabbit mother considered. But no significant interaction was observed between the effect of mother and the effect kits origin. Because variations of breeding capacities between individual local does was not the object of this experiment, only the effects of kits origin were presented.

When 6 days old, *i.e.* 3 days after their arrival in CECURI, the imported sucklings were significantly heavier **(P <** 0.001) than the natives. Their mean weight (td˙ 80 g), indicated that the adoption was successful.

Between days 6 and 21 no significant difference on weight gain was evident (P = 0.43). During this period, the quasi exclusive source of feed was milk. According to literature (LEBAS, 1969; McNitt and MOODY, 1988) during the 3 first weeks of lactation, the efficiency of transformation of milk into weight gain by kits is quite independent from the quantity of milk ingested by the kits or from the breed in consideration. Then it can be assumed that both the imported and native rabbits consumed an equivalent amount of milk.

It must pointed out that the average 21-days weight (233 g) is lower than that observed for young rabbits of the same age raised in TOULOUSE : 320 g for NZW rabbits (JOUGLAR, 1993) or 294 to 333g according the mother diet, for commercial hybrid rabbits (LEBAS and FORTUN-LAMOTHE 1996). This average lower weight was most probably related to a lower milk production of the local does, as a combined effect of strain, feed quality and climatic environment. Nevertheless as a partial conclusion at this point of the results analysis *i.e.* on day 21 of kits life, it must be emphasised that the imported rabbit were well adapted to the local breeding conditions. Because of the relatively low milk production of the fostering does, it can assumed that imported NZW rabbits were not able to express completely there growth capacity. Then for these imported rabbits, a compensatory growth following this "restriction period" can be expected as soon as an other feeding resource would be available as it is observed in all cases for older growing rabbits (PERRIER, 1998). On the contrary, nothing can be said about the native kits because no reference is available for this strain, in other conditions.

During the following period, the most remarkable result concerns the weight gain of the young between day 21 and weaning at 31 days. The native rabbits had a growth rate 30% higher than the imported ones (17.1 *vs* 13.0 g/day) **(P<** 0.001). So, instead of the expected compensatory growth of imported rabbits, a reduced growth rate was observed. Taking into account the mode of distribution of fostered and native kits (3 of each type in each litter) and the similar growth rate observed between 6 and 21 day, no differential milk intake after 21 days can be suspected between the 2 types of kits. In addition, as mentioned above, the weight gain up to 21 days suggest a good acclimatisation of the « TOULOUSE kits » to the African environmental conditions. The fourth week of young's life corresponds to natural weaning which implies an increasing consumption of solid food. So, since milk intake is assumed to be identical, either the young rabbits from TOULOUSE ate less solid food or they digested it less efficiently. Two main hypotheses could be put forward to explain this lowered growth in the European rabbits fostered by African does.

• First, both strains may differ in term of digestive adaptation and perhaps in the genetic make-up that controls these characters. We can imagine that the native strain is adapted to the coarse meal. This would mean that the genetically-driven adaptation to feed is a

rapid process. Before the development of a rational breeding system in CECURI, the animals were only fed with forages generally without adjunction of concentrates. In addition, the African strain results from crossings with the TOULOUSE strain and the present experiment was performed only 3 generations after this genetic mixing. In addition, a difference of feed efficiency was unlikely, since no difference in feed digestibility was observed between selected and unselected rabbits (OuHAYouN and CHERIET, 1983). Then, this hypothesis is highly improbable.

• A second cause of the lower growth rate of the TOULOUSE kits fostered with African does consuming the local feed could be related to a chemosensory disturbance during the weaning process. Food selection at weaning has been shown to be very sensitive to earlier experience with food odours (GALEF *et al.*, 1994). It has been shown that mammalian foetuses and neonates are highly sensitive to their odour environment (SCHAAL and ORGEUR, 1992). Specifically in the rabbit, odours present in the foetal environment can determine locational preferences within the first postnatal week (BILKO *et al.*, 1994; COUREAUD *et al.*, 1997). This prenatal learning remains active in the long-term, as it can exert an influence on food choice at weaning : young born of does fed juniper berries during pregnancy (and then exposed or not to juniper odour through milk) evince a clear preference for the juniper odour 28 days after birth (HUDSON and ALTBACKER, 1994). A similar effect could have been at work in the present experiment where the TOULOUSE sucklings were exposed both prenatally and during the first sucklings to the flavours of the TOULOUSE feed. This early TOULOUSE feed odour learning might have interfered with the CECURI food acceptance during spontaneous weaning , therefore impeding feed intake and then growth in the TOULOUSE kits adopted by CECURI does. This hypothesis is currently being experimentally examined with does and rabbit kits of only one strain, but fed with two experimental diets differing only for the odour (one control diet and the same diet supplemented with natural odour).

In addition, it can pointed out that the average weaning weight of imported rabbits (365 g) was only about one half of that of their siblings reared in Toulouse : 688 g (TUDELA and ROCHAMBEAU, 1997, personal communication). Since, as previously mentioned, the pre-weaning mortality was lower in the CECURI rabbitry than in the INRA Research Centre, the lower growth rate of the NZW sucklings in Benin cannot be related to a bad sanitary environment, but only to the climatic and nutritional environment.

CONCLUSION

This trial confirms that by using an appropriate method the transfer of 1- or 2-days-old new-born rabbits towards hot climate countries is possible without loss. Moreover the adaptation of the sucklings was fully satisfying up to weaning. Since no difference was observed in the 6-21 days growth rate between the 2 types of rabbits, it can be concluded that imported NZW rabbit have no significant advantage during this period when compared to local rabbits in our conditions.

A slight but significant decrease of growth was noted when the NZW sucklings began to eat the local feed. This lower weight gain of imported young is supposed to be a consequence of lower feed assimilation or more probably of lower feed acceptance. Different hypotheses were proposed to explain the differential performance between both treatments. These alternatives should be tested in future experiments.

As mentioned in the introduction, the present experiment was the first step of a more general study on the real contribution of genetic potential of rabbits to low growth performance of rabbits reared under tropical conditions. According to our experimental design, imported European rabbit have no weight advantage at weaning when compared to local:y bred rabbits. On the contrary their weaning weight was slightly but significantly lower than that of the local rabbits. So at the start of the fattening period experimental, conditions are satisfying for the comparison: similar adaptation of imported and local rabbits, and a slight handicap for the strain presumed to have the highest rate of growth.

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