



GUINEA-PIG PRODUCTIVITY UNDER TRADITIONAL MANAGEMENT

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ABSTRACT

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Results of a 12 month study of traditional guinea-pig production in the western highlands of Cameroon are reported. The mean age of guinea-pigs (*Cavia porcellus* L.) at first parturition, kidding interval and litter size at birth were 126.30 ± 10.40 d, 64.8 ± 1.70 d and 1.63 ± 0.26 kids respectively. The annual reproductive rate was 9.18 kids/breeding doe while the doe post-partum weight was 530 g. Mean body weights at birth, presumed weaning (21 d) and 15 weeks of age were 78.36 ± 3.20 , 147.51 ± 8.10 and 418.88 ± 32 g respectively. Type of birth and sex had a significant effect on body weight at all ages. Birth weight dropped significantly from 83.88 ± 2.87 g for singles to 81.57 ± 3.40 g for twins, 74.25 ± 2.39 g for triplets and 73.75 ± 4.12 g for quadruplets. These differences were maintained to maturity (15 weeks). Males were generally heavier than females. Mortality rates were relatively high among kids: 24% at birth, 39% at 3 weeks and 40% at 15 weeks. Productivity indices were 0.827 kg of young weaned per doe per year, 1560 g of young weaned per kg of doe per year and 2.52 kg of young weaned per kg metabolic weight ($\text{kg}^{0.75}$) of female per year.

INTRODUCTION

During recent years there has been a growing interest in the use of mini-livestock, including guinea-pigs (*Cavia porcellus* L.) to increase and diversify livestock production. This species is important for animal production in Latin America (Sandoval, 1989; de Urrioda, 1990; Hardouin *et al.*, 1991; Castrovilli *et al.*, 1993; Morales, 1994) and in Africa south of the Sahara, mainly of the Sudano-guinean zone (Ngou Ngoupayou *et al.*, 1994; Fransolet *et al.*, 1994). However, very few studies have been carried out on the improvement of their productivity. This paper describes a study on the production characteristics and constraints of guinea-pigs kept under traditional management in the western highlands of Cameroon.

MATERIALS AND METHODS

Study site

The western highlands of Cameroon (WHC) is situated in the Sudano-guinean zone (latitude 5 to 7°N, longitude 8 to 12°E). The average altitude varies from 1400 to 2000 m. Climate varies widely and largely depends on altitude. The mean temperature and

relative humidity are 16 to 17°C and 49 to 97% respectively. The wet season is from March to November with an annual rainfall of about 1600 mm, followed by a dry season from late November to March.

Husbandry practices

Guinea-pig production is carried out as a sideline by 30% of women in the WHC. The mean flock size is about 7 animals. They provide meat and a flexible source of additional income. Adults and young are generally raised in the kitchen and mating is haphazard. Animals scavenge on the floor for their daily needs. Most food is provided from harvest wastes, household scraps and sometimes supplemented with vegetables and forages. Watering is not considered essential and animals rely on the forages to meet their requirements.

Survey methodology

A total of 65 households owning 453 guinea-pigs were selected from 10 villages and monitored for 12 months. At the start of the study, all animals were ear tattooed, weighed and their sex determined. Animals were then weighed fortnightly, while birth type, sales and deaths were recorded whenever possible. To gain the confidence of the farmers, guinea-pigs were treated for mites once a month and dewormed. However, farmers were free to sell, slaughter or dispose of the animals in any way desired and at any time.

Parameter computation and statistical analyses

The following parameters were calculated using the method described by Johann and Hardouin (1987): age at first kidding, kidding interval, average litter size at birth, annual reproductive rate and mortality rate. Productivity indices were defined as:

- Index I: kg of young produced per female per year;
- Index II: g of young produced per kg liveweight of female per year;
- Index III: kg of young produced per kg metabolic weight of female per year;

and estimated as:

$$\begin{aligned}
 - \text{ Index I} &= \frac{\text{Litter size weight at 21 days} \times 365}{\text{Parturition interval}} \\
 - \text{ Index II} &= \frac{\text{Index I}}{\text{Doe post-partum weight}} \\
 - \text{ Index III} &= \frac{\text{Index I}}{\text{Doe post-partum weight}^{0.75}}
 \end{aligned}$$

The effect of type of birth and sex on weights at birth, 21 days and 15 weeks were analysed separately using the completely randomized design, and means were separated using the Duncan's New Multiple Range test ($p=0.05$) (Steel and Torrie, 1980). The effects of type of birth and sex on mortality rate were determined using χ^2 analysis with mortality of singles used as the expected means (Steel and Torrie, 1980).

RESULTS

Reproductive performance is presented in Table I. The mean interval between first and second litters (63.5 days) was shorter than those that occurred between later parities (65.6 days). Average litter size was 1.63 increasing from 1.17 ± 0.20 from primiparous does to 1.84 ± 0.30 in older animals. The incidences of litters of single animals, twins, triplets and quadruplets were 44.56%, 49.74%, 3.63% and 2.07% respectively. The annual reproductive rate was 9.18 kids/doe being lower in primiparous (5.44) than in multiparous animals (11.8). The mean post-partum weight of does (530 g) varied with parity (age) of does and type of parturition. No seasonal pattern of farrowing was observed and kids were born all year round.

Growth and weight of young

The mean birthweight was significantly ($p < 0.05$) affected by type of birth and sex (Table II). Males were heavier than females at birth; kids of older females weighed more than those of younger females. Kids born as singles were heavier at birth than those born as twins, triplets or quadruplets. These differences were maintained to 3 weeks and 15 weeks. The mean daily weight gain from birth to 15 weeks varied from 3 to 4 g/d.

TABLE I
Reproductive performance of local guinea-pigs in the western highlands of Cameroon

Variable	No. of records	Mean \pm SE	Range
Age at first parturition (d)	173	126.30 \pm 10.40	115–151
Parturition interval (d)	96	64.80 \pm 1.70	60–70
Litter size at birth	383	1.63 \pm 0.26	–
Annual reproductive rate (young/doe per year)	383	9.18 \pm 1.31	–
Post-partum weight of doe (g)	266	530.00 \pm 29.62	–

TABLE II
Growth performance of local guinea-pigs at different ages in the western highlands of Cameroon

Variable	Births ($\bar{x} \pm$ SE)	3 weeks ($\bar{x} \pm$ SE)	15 weeks ($\bar{x} \pm$ SE)
<i>Type of birth</i>			
Single	83.88 \pm 2.87 ^a	155.00 \pm 2.88 ^a	436.78 \pm 10.70 ^a
Twin	81.57 \pm 3.40 ^{ab}	153.36 \pm 8.81 ^a	422.02 \pm 11.60 ^{ab}
Triplet	74.25 \pm 2.39 ^b	146.66 \pm 9.83 ^b	412.26 \pm 12.18 ^b
Quadruplet	73.75 \pm 4.12 ^b	135.00 \pm 11.01 ^c	404.46 \pm 13.12 ^c
<i>Sex</i>			
Males	79.40 \pm 3.20 ^a	153.70 \pm 9.90 ^a	430.21 \pm 37.50 ^a
Females	77.32 \pm 2.90 ^b	141.30 \pm 8.70 ^b	407.55 \pm 26.50 ^b
Overall mean	78.36 \pm 3.20	147.51 \pm 8.10	418.88 \pm 32.00

Within variable groups, mean followed by different letter differ significantly ($p < 0.05$)

Feed efficiency

Under traditional management, it is almost impossible to evaluate this index as animals are fed randomly on forage, kitchen refuse and agricultural by-products and by anyone in the family. An unpublished feeding trial was conducted on station to test 4 diets made up of *Trypsacum laxum* and *Pennisetum purpureum* together with either sweet potato leaves and soybean meal or *Arachis glabrata* and soybean meal as supplement, to contain 20% crude protein each. Results indicated that feed efficiency ranged from 9.9 to 10.2 with a mean weight gain of 3.2 to 3.7 g/d.

Mortality and offtake of young

Type of birth and sex resulted in the expected trend in mortality, with more offspring of multiple than of single birth dying (Table III). More than 60% of preweaning deaths (21 days) were stillbirths or occurred in the first day of life (24%) and a further 16% of kids died during the first week of life. The cumulative mortality recorded between birth and 21 days was 38.93% and increased to only 39.50% at 15 weeks. Kids were the most vulnerable component of guinea-pig flocks and any attempt made to assure their survival is bound to increase productivity and economic returns. The most important disease observed was pneumonia in the rainy season when the conditions were damp and humidity was very high. Deaths from unknown causes were high at 18% of total mortality. The weak condition of most kids and older animals that died could be attributed to inadequate nutrition; predation by cats and snakes was also a risk to both adults and young animals. Offtake due to slaughtering for home consumption, cash sales and gifts were 40%, 55% and 5% respectively. The relatively high commercial offtake suggests that guinea-pigs are an important source of income for small farmers. Over 80% of total offtake was slaughter and sale of males. Females were preferred as gifts. Males over 15 weeks were more likely to be sold or offered as gifts than younger ones.

The productivity index

The productivity indices I, II, III at presumed weaning (21 days) were computed to be 0.827 kg of liveweight of kids weaned/doe/year, 1560 g weight weaned per kg of doe per year and 2.52 kg weaned per kg metabolic weight of female per year.

TABLE III
Cumulative mortality rate of guinea-pigs at different ages in western highlands of Cameroon

Variable	No. born	Age group		
		Birth (%)	3 weeks (%)	15 weeks (%)
<i>Type of birth</i>				
Single	172	7.80	11.90	12.70
Twin	384	10.90	16.20	17.12
Triplet	42	27.10	45.70	45.83
Quadruplet	32	51.60	81.90	82.40
Overall mean	630	24.35	38.93	39.50

DISCUSSION

In this study, the age of 126.3 days at first parturition was consistent with reports by Castrovilli *et al.* (1993) but earlier than the 134.6 days reported by Fotso *et al.* (1995) in Cameroon or by Cicogna *et al.* (1993) in Italy. Management practices to control breeding are generally designed to delay the age at first parturition. Males are separated from the females and females are mated only on attaining a specified minimum weight or age. In this study, where females and males were put together and could mate at any time, early parturition was expected. Uncontrolled breeding did not only lead to some females being bred too early, it also allowed for the perpetuation of inferior genotypes resulting in low conception rate, low birth weight and kid survival. Thus, the mean litter size at birth of 1.63 was lower than the reported 1.9 from Fotso *et al.* (1995), or 3 to 4 from Fransolet *et al.* (1994) in Gabon, Morales (1994) in Peru and Castrovilli *et al.* (1993) in Italy. In our study litter size could be biased downward because of the larger number of young does included in this analysis (first to second parturition). Also poor nutrition could largely be responsible for the low average number of kids born to does in the flock. Nevertheless, high prolificacy rate did not seem desirable because young mortality increased with increase in prolificacy.

The estimated annual reproductive rate of 9.18 young/doe per year was higher than the result reported by Fotso *et al.* (1995) or Chauca *et al.* (1988), but lower than 13.6 reported by Castrovilli *et al.* (1993). This could be attributed to the shorter parturition interval obtained from this study; however, this parameter seems to be related to management rather than animal factors. With the estimate of kidding interval, it could be possible to implement 5 to 6 kiddings per year.

Kidding rate was higher than the estimate of 3 to 4 litters/year proposed by Chauca *et al.* (1988), but consistent with the findings of Fotso *et al.* (1995). Birth weight was lower than the reports of Fotso *et al.* (1995) or Tsalla (1985) using research station data. Daily weight gain was in the same range as that reported by Fotso *et al.* (1995) and Sandoval (1989) but lower than the results of Johnston and Uzcategul (1988). These variations could still be explained by the differences in management, the relative occurrence of litter types or the significant variability in the genetic pool. Considering the female as the major input to the weight of young at weaning, the productivity estimate of index II (1560 g of kid at 21 d/kg liveweight of females) was higher than the estimates of 867, 494, 163 g in sheep, goats and cattle respectively in central Mali or the 547 g for sheep in western Sudan or 867 g for Sudan Desert sheep (Wilson and Light, 1986). Also estimates of index III (2.52 kg of young at 21 d/kg metabolic weight of doe per year) was superior to 2.22, 1.23 and 0.704 kg for sheep, goats and cattle respectively in central Mali (Wilson and Light, 1986) or the 1.34 kg of sheep in western Sudan traditional system or 2.22 kg for Sudan Desert sheep (Wilson and Light, 1986).

Feed efficiency in guinea-pigs used in the reported trial seems to be greater than values recorded in rabbits (Harris *et al.* (1984). This could be related to the relatively low energy density of diets mainly based on forage. It is apparent that this species could be an effective means of converting forages and agricultural by-products into high quality animal protein although a more in-depth study of the nutritional requirements of indigenous guinea-pigs would be necessary.

Prewearing mortality in the study was higher than the reports of Fotso *et al.* (1995), the system of management and the availability of veterinary care being the affecting factors.

The results of this study suggest that guinea-pigs could play a major role in the supply of animal protein in rural areas. Animals require small amounts of feed, and inexpensive and easily constructed housing may be used. They also provide small carcasses that can be consumed by a family in one meal eliminating the need for meat storage and refrigeration. Their productivity indices are higher than those of goats, sheep and cattle suggesting that they can provide a source of animal protein and be an additional source of family income. However, improvements in management and disease control are required for sustainable increase in productivity of both kids and adults.

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Productivité des cochons d'inde en élevage traditionnel

Résumé – Les résultats d'un an de suivi des élevages de cobayes (*Cavia porcellus* L.) dans les Hauts Plateaux de l'Ouest Cameroun sont présentés. L'âge moyen à la première mise bas, l'intervalle entre parturition, et la taille moyenne de la portée sont de $126,30 \pm 10,40$ jours, $64,80 \pm 1,70$ jours et $1,63 \pm 0,26$ respectivement. Le taux annuel de reproduction est de 9,18 petits par femelle alors que le poids moyen des femelles après mise bas est de 530 g. Le poids à la naissance, au probable sevrage (21 jours) et à 15 semaines d'âge sont de $78,36 \pm 3,20$ g, $147,51 \pm 8,10$ et $418,88 \pm 32$ g respectivement. Les types de naissance et le sexe ont significativement affecté les poids à différents âges. Le poids à la naissance décroît significativement de $83,88 \pm 2,87$ g chez les simples à $81,57 \pm 3,40$ g chez les naissances doubles, $74,25 \pm 2,3$ g chez les triplets et $73,75 \pm 4,12$ g chez les quadruplets. Ces différences sont maintenues jusqu'à la maturité (15 semaines). Les mâles pèsent généralement plus que les femelles. Les taux de mortalité sont plus élevés chez les jeunes: 24% à la naissance, 38% à 21 jours et 40% à 15 semaines. Les indices de productivités sont de 0,827 kg de jeunes sevrés par femelle et par an, 1520 g de jeunes sevrés par kg de poids de la femelle et 2,52 kg de poids de jeunes par kg du poids métabolique ($\text{kg}^{0,75}$) de la femelle.

Productividad del cobaya en un sistema de manejo tradicional

Resumen – Se presentan los resultados de un estudio de 12 meses de duración sobre el sistema tradicional de producción de cobayas (*Cavia porcellus* L.) en las tierras altas occidentales de Camerún. La edad media al primer parto, el intervalo medio entre partos y el tamaño medio de la camada fue respectivamente de $126,3 \pm 10,40$ días, $64,8 \pm 1,70$ días y $1,63 \pm 0,26$ crías. La tasa reproductiva anual fue de 9,18 crías por hembra, mientras que el peso medio de las hembras después del parto fue de 530 g. El peso medio al nacimiento, al destete (21 días) y a las 15 semanas de edad fue respectivamente $78,36 \pm 3,20$, $147,51 \pm 8,10$ y $418,88 \pm 32$ g. Tanto el sexo como el tamaño de la camada tuvieron un efecto significativo sobre el peso a todas las edades. El peso al nacimiento fue de $83,88 \pm 2,87$ g en partos de una cría, $81,57 \pm 3,40$ g en partos dobles, $74,25 \pm 2,39$ g en partos triples y $73,75 \pm 4,12$ g en partos cuádruples. Estas diferencias se mantuvieron hasta la madurez (15 semanas). Los machos fueron generalmente más pesados que las hembras. La tasa de mortalidad en las crías fue relativamente alta: 24% al nacimiento, 39% a las 3 semanas y 40% a las 15 semanas. Los índices de productividad fueron de 0,827 kg de animal joven destetado por hembra y año, 1569 g de animal joven destetado por kg de hembra y año, y 2,52 kg de animal joven destetado por kg de peso metabólico ($\text{kg}^{0,75}$) de hembra y año.