Bio-Economic Evaluation of the Performance of Rabbits Raised Under Two Different Housing Systems

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Summary

This study was conducted to evaluate the bio-economic performance of rabbits raised under two different housing systems: conventional hutch with cage system as control (A) and the non-conventional floor housing system (B). Thirty six adult rabbits of medium size breed category of both sexes aged 5-6 months comprising Chinchilla (20), New Zealand White (10), Dutch (6) were used in the study which lasted 24 weeks. Fifteen does and 3 bucks were each randomly but equally assigned to both housing systems. Data on individual and group treatments were analysed with a one-way analysis of variance and students' t-test, employed in testing differences between the means. A benefit-cost analysis was used to evaluate the relative cost effectiveness of each housing option. Results obtained showed that rabbits raised on floor performed better (6 kittens) < 0.05 biologically than those reared in hutched (3 kittens). For example, significant final weights (1.9 kg) and weight gains (0.4 kg) were observed in rabbits reared on floor as against those in hutch 1.6 kg and 0.09 kg). From an economic viewpoint, rabbits raised on floor contributed higher positive income (₦ 58.2) per unit of meat produced than rabbits reared in hutch or cage. Rate of return on investment in the former was estimated at about 50%. The floor housing system which is the cheaper, more productive and cost-effective is therefore recommended for farmers who are lacking the fundamental factors of production namely land and particularly capital as observed in the study location or environment.

Résumé

Evaluation bio-économique de la performance des lapins sous logement conventionnel et non-conventionnel dans des conditions humides et tropicales

Cette étude a été réalisée afin de comparer deux systèmes de logement sur la performance bio-économique de l'élevage des lapins. Ces systèmes étaient le témoin (logement traditionnel en clapier) et le traitement (logement non conventionnel en étages). Trente-six lapins adultes de race mi-lourde (20 de Chinchilla, 10 de New Zealand White et 6 de Dutch) ont été utilisés et l'essai a duré 24 semaines. Quinze femelles et trois mâles âgés entre 5 et 6 mois ont été randomisés et répartis respectivement entre le témoin (A) et le traitement (B).

Les données individuelles ainsi que celles des groupes de traitements ont été analysées par l'analyse de la variance à un critère et la différence entre les moyennes a été comparée par le test t- de Student. Les résultats obtenus montrent que le traitement (B) a une meilleure performance biologique comparativement au témoin (A). Les moyennes des poids des lapins adultes et le gain de poids étaient respectivement de 1,98 kg et de 0,35 kg pour le traitement (B) alors que ceux du témoin (A) étaient faibles, respectivement de 1,65 kg et de 0,90 kg. Au point de vue économique, les lapins élevés en étages ont généré un revenu plus élevé comparativement au témoin et représentait 58,18 ₦ par unité de viande produite. Quant au revenu d'investissement, il a été estimé à environ 50%. En conclusion, le système de logement en étage, comme le démontre cette étude, est moins cher, plus productif et à coût faible. Il est donc recommandable aux fermiers à faibles revenus.

Introduction

Protein intake in the diet of the average Nigerian both in terms of quality and quantity is widely acknowledge to be inadequate. For example, 35 g out of the required minimum of 65-72 g of reference protein in the diet of the average Nigerian should be obtained from meat products; but regrettably, only 8.4 g out of the 53.8 g of protein consumed per head per day in Nigeria comes from animal sources (2, 7, 10). The remedy to the perceived protein deficiency situation in the country calls for increased supply of animal protein products such as beef, pork, mutton, chevon, milk, poultry, lago meat, etc. (3).

Hitherto, Government's animal production programmes had tended to emphasise increased supply

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of conventional livestock products such as beef, pork, mutton and chevon as well as poultry. However, the undue emphasis on these conventional animal products notwithstanding, the animal production subsector of the Nigerian economy has not been able to meet the minimum protein requirements of the teeming population. If the target of food for all by the year 2010 is to be met, there is the need to consider all available options including the promotion of non-conventional micro-livestocks such as rabbit. Rabbits are very prolific, producing at least 4-5 litters per year with litter sizes of 6-8 kitten. They have a short gestation period of 30-32 days and do not compete with man for grains since they could rely solely or largely on fibre rich forages and kitchen wastes to satisfy their basic nutritional requirements (1, 5, 9).

In view of the foregoing advantages, farmers in Nigeria are being encouraged to produce rabbits as a way of meeting the minimum protein needs of their families as well as boosting animal protein supply in the country. Currently, rabbit production in Nigeria is carried out mainly in hutches. This production technology is reported to have deterred prospective rabbit farmers because of its high cost. Besides, field reports by farmers using the hutch system have indicated considerable mortality among their rabbit colonies even when feeding seems to be optimum (5). This study was therefore designed to evaluate the relative bioeconomic performance of rabbits raised under the non-conventional semi natural floor system against the conventional hutch system.

Material and methods

1. Physical weather conditions, animals and treatment

The study was done in a University environment with a coastal setting in the southern most part of Nigeria and located within the typical tropical rain forest belt. The environment is hot and humid with mean daily maximum and minimum temperatures of 21-33 °C and 20-23 °C respectively. Although a relatively photostable climate with 12 hours of diurnal light all year round, the high cloud cover tends to diminish the sunshine hours to as low as 1.5 hour (sometimes) to 6 hours daily. Precipitation is quite high (1,700-4,500 mm annually) with correspondingly high relative humidity of 50-90%, depending on the season of the year. There are two seasons (rainy and dry), and in some years the rains fall every month of the year. Unlike some part of Nigeria, the dry season is usually short (3 months or less).

Thirty-six 5-6 months-old adult rabbits of different sexes comprising medium breed rabbits, namely Chinchilla (20), New Zealand White (10) and Dutch (6) were used in the experiment for this study. The animals were equally but randomly assigned to two groups, A (control) and B (treatment) of 18 animals each (comprising 3 males and 15 females). There were six animals per replicate and three replicates per treatment.

Group A comprising 18 rabbits which served as the control were housed in conventional hutches housed in a building with concrete floor. The hutches were designed to allow enough ventilation (half wall and the rest were covered with wire mesh of 1.27 cm). The rabbits were housed one per compartment in a two-tier conventional hutch of six compartments, made up of wire mesh and metal frame, with litter pans placed under each cage. Mesh or grid openings were large enough to allow faecal pellets to drop through readily, yet small enough to provide comfort and prevent their feet from becoming entangled. The grid of the wire mesh for the floor was 15 mm while the mesh size was 1.27 cm x 2.54 cm. The cage dimensions were 1.2 m x 0.6 m x 0.6 m for length, height and width, respectively. The legs of the hutches were 1.0 m above the ground. A total of four hutches were used. Three hutches were used to house the replicates while the remaining one was used to house the weaners. The bucks were housed separately except when needed for mating the does and this was done conventionally (4).

Group B comprising 18 rabbits which served as treatment were housed in a hut with a floor area of 5 m x 4 m for the length and width, respectively. They were placed on deep litter non-concrete floor to encourage burrowing. Wood shavings were used as the deep litter material and the depth of the litter was 12.70 cm. The floor area was divided into three with wire mesh wooden frames dug into the ground to accommodate each replicate of six animals. The floor space per rabbit was 1 m^2.

All the experimental animals were tagged, allowed one-month pre-conditioning period, and medicated against common diseases like coccidiosis and mange. They were administered prophylactic coccidiostat (Ampro-vitracycline) via drinking water at the rate of one teaspoon into 4 litres of water. They were also dipped with cinatic powder (one sachet) into 9 litres of water and bleached with palm oil mixed with fresh citrus leaves as a treatment against mange. Standard sanitary regimes such as daily washing of feeders, drinkers, trays and disinfecting the pens were maintained in both housing systems. All the animals were subjected to similar management/husbandry conditions of feeding and hygiene except the housing system. The animals were fed 50 g of poultry growers mash and forage *ad libitum* such as *Panicum maximum* (grass); *Centrosema pubescens* and *Calopogonium mucunoides* (legumes). The experiment lasted for 24 weeks, after the does had been bred according to standard procedures of taking the females at a time to the males (bucks) (1, 11).

2. Statistical design/analytical techniques

The experiment was a completely randomised design. Data collected on individual and group treatment include growth rate (initial body weight, final body weight, food intake, body weight gain, and feed efficiency), mortality, physical and service inputs used and costs, and market value of a kilogram of lago meat in the study area. On the basis of these data, a cost-benefit analysis was undertaken for each housing system. The mean values of rabbit meat obtained from each housing system were estimated and a student

t-test employed to test for differences between the means as outlined by Snedecor and Cochran (13).

Results and discussion

1. Production parameters

The productive performances of rabbits raised under the two different housing systems are presented in table 1. Whereas there was no significant difference (P> 0.05) in average initial weights of rabbits reared under the two housing systems, a significant difference (P< 0.05) in final weight in favour of the floor system (1.98 ± 0.18 kg) over those in the hutches (cages) 1.65 ± 0.13 kg) was observed. Average weight gain and feed efficiency were also significantly higher (P< 0.05) in the floor system than in the hutch system. However, there was no significant difference (P< 0.05) in their average feed intake, although higher for treatment B.

Table 1

Effect of housing system on productive performance of rabbits

Production Parameter	Treatment A Hutch or Cage	Treatment B (Floor)
Average initial weight (kg)	1.6[a] ± 0.1	1.6 ± 0.1
Average final weight (kg)	1.7[a] ± 0.1	2.0[b] ± 0.2
Average weight gain (kg)	0.1[a] ± 1.2	0.4[b] ± 0.2
Average feed intake (kg)	77.5[a] ± 13.6	83.5[a] ± 1.8
Mean litter size	3.4[a] ± 0.8	6.1[b] ± 1.3
Mean litter weight (g)	40.1[a] ± 3.1	48.8[b] ± 3.7
Average weaning weight (g)	429.6[a] ± 48.0	536.9[b] ± 84.0
Total number weaned / doe/litter	2.3[a] ± 0.9	5.8[b]
Mortality (%)	34.2[a] ± 0.9	6.0[b] ± 0.7
Mortality of young	27[a]	7[b]

[a], [b] means within the same row with the same superscript denote not significantly different (P< 0.05).

The growth rate of the young for the first 56 days from day old to weaning was evaluated and the results are presented in table 2. The observed differences in treatment means with regards to weekly weight gain were statistically significant (P< 0.05) with treatment B being superior to A at 14-28 days and 28-42 days. The observed differences in treatment means on weekly weight gain were not statistically (P< 0.05) significant at 0-14 days and 42-56 days. However, treatment B showed overall numerically superior mean values.

Litter size was nearly twice as high (P< 0.05) when housed on floor (3.4 and 6.1 respectively). The number of weaned kits as well as the weights were significantly higher for treatment B. Mortality was high in caged rabbits among both the adults and young, and was significantly lower among the group on the floor.

Table 2

Average weekly weight gains of experimental kits for the first 56 days

Production Parameter	Treatment A	Treatment B
Mean litter weight (g)	40.1 ± 3.0	48.8 ± 3.8
Weight gain at 0-14 days (g)	75.8 ± 26.3	78.1 ± 16.3
Average daily Wt gain (g/d)	5.4	5.6
Cumulative Wt gain (g)	155.9 ± 28.2	126.9 ± 17.4
Weight gain at 14-28 days (g)	94.8 ± 20.6	143.8 ± 37.3
Average daily Wt gain (g/d)	6.8	10.3
Cumulative Wt gain (g)	210.7 ± 57.1	270.7 ± 83.6
Wt gain at 28-42 days (g)	109.9 ± 18.5	145.7 ± 32.1
Average daily wt gain (g/d)	7.8	10.4
Cumulative weight gain (g)	320.6 ± 75.4	416.4 ± 62.8
Wt gain at 42-56 days (g)	109.5 ± 26	120.7 ± 32.4
Average daily wt gain (g/d)	7.8	8.6
Cumulative wt gain (g)	429.6 ± 48.0	536.9 ± 84.0
Average daily body Wt gain for first 56 days (g/d)	7.0	9.0
Mean daily Wt gain		8.0

[a], [b] means within the same row with the same superscript are not significantly different (P> 0.05).

From the biological viewpoint, the results shown in tables 1 and 2 indicate that with the same level of concentrate feed and forages as well as the same standard breeding procedures (1, 4), higher significant average final weights and weight gains were recorded in the rabbits raised on floor viz. 1.98 kg and 0.36 kg as against 1.65 kg and 0.09 kg in those reared in hutches respectively. This might be due to what Fielding (6) explained as the "instinctive wisdom" of the rabbit which helps it to select good balanced diet which the floor system enables the young to increase its feed by eating fibrous litter material from the floor to balance its fibre requirements. This observation is consistent with those of Slade and Hintz (12), Ndor (8) and Timibitei (14) who had earlier remarked not only increased feed intake and feed efficiency but also increased litter size among rabbits reared on the floor. This observation is quite fascinating in this study as the littersize was not only doubled but also mortality which is the bane of rabbit farming in Nigeria was found to be considerably reduced among those reared on the floor.

A number of explanations can be adduced for the observations noted in tables 1 and 2; for instance, poultry mash is better suited for rabbits which can supplement their diets with the litter material as in treatment B. Secondly, higher heat load or stress could be anticipated for the caged rabbits. Finally, the breeding system which consisted in monitoring "latent" heat signs in the does (female rabbits) and then introducing them in the male hutches for mating after observed heat/oestrus signs (4) made some of the results on these parameters rather tentative. This fact did not however invalidate the more essential points in the tables as the breeding results were found to be much better and the weight gain of the young was considerably (P< 0.05) higher.

2. Bio-economic performance parameters

Building on the biological production parameters given in tables 1 and 2, a cost-benefit (or cost-return) analysis was conducted in order to ascertain the relative cost-effectiveness of the two production technologies. In doing this, the inputs employed in each production option were quantified and valued at their purchase price or opportunity cost. The resulting output, measured in average final weight of young produced, was also valued at the prevailing market price. The difference between these two quantities gave us a measure of the income contribution per kilogram of lago-meat produced. The resulting figures from these analyses are given in table 3.

Table 3

Cost-return analysis of the performance of kitten reared under two housing systems (Unit= ₦)

	Item	Treatment A	Treatment B
A.	**Fixed cost**		
	Depreciation:		
*	Cages	35	0
*	Feeders/drinkers, etc.	2	2
*	Rent on housing	2	2
	Total fixed costs	39	4
B.	**Operating costs**		
*	Feed	25	25
*	Animal health care	47	23
*	Labour	60	44
*	Transport	20	9
*	Miscellaneous	40	14
	Total operating costs	192	115
	Total production costs	231	119
C.	**Value of production**		
*	Total weight gain (g)	429.6[a]	536.9[b]
*	Unit value of meat (₦/g)	0.33	0.33
*	**Value of production**	141.78	177.18
D.	**Estimated income**	(89.22)	58.18
E.	**Benefit - cost ratio**	0.61	1.5

[a], [b] means within the same row with the same superscript are not significantly different (P< 0.05). Figure in parenthesis is a negative figure.

The results in table 3 indicate that from an economic viewpoint, rabbits raised on floor contribute higher positive income per unit of meat produced. Income contribution per unit of meat produced under the cage system was observed to be negative. This implies that returns are inadequate to defray the costs associated with production under this system. This is understandable given the higher cost of cages, the stress suffered by the young rabbits raised under this system, the higher costs incident on the greater attention accorded the young, and the high mortality rate recorded under this system. Because of the greater attention accorded the young rabbits raised under the hutch system, higher costs are incurred in labour input and in the provision of health care services. This coupled with the low feed efficiency, weight gain, and litter size discourages cost-effectiveness in this system of housing.

Consequently, for every ₦ 100.00 worth of production inputs employed in rabbit production under the hutch system, only ₦ 61.00 was realised as revenue. Thus for every ₦ 100.00 costs incurred, a loss of about ₦ 39.00 resulted. Conversely, every ₦ 100.00 worth of production inputs employed in rabbit production under the floor system, about ₦ 150.00 was realised as revenue. Thus for every ₦ 100.00 costs incurred, a profit margin of ₦ 50.00 resulted. This gives a rate of return on capital investment of about 50%.

Conclusion

This study has shown that both from the biological and economic viewpoints, rabbits raised under the floor or deep litter housing system perform significant better than those raised in the conventional cage (hutch) system. Performance indicators considered in this study include feed conversion efficiency, growth rate, litter size, mortality as well as income per unit weight of meat produced. For example, significant average final weight and weight gains were observed in rabbits raised on floor (1.98 kg and 0.36 kg) as against those in cage or hutch (1.65 and 0.09 kg), respectively. Similarly, from an economic viewpoint, rabbits raised on floor contribute higher positive income per unit of meat produced. Between the two production technologies, therefore, the floor housing system is the cheaper and more productive biologically and economically. This technology is therefore more cost-effective and appropriate for resource poor farmers as we find in the area of study. It should therefore be further replicated, revalidated, and packaged for dissemination to farmers in the area.

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