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Effect of dietary restriction on the growth and survival of young rabbits *Oryctolagus cuniculus* (Linnaeus, 1758)

***Athanase Kraidy Otchoumou, Franck Konan Yao, Marie Flavienne Raîssa légbé Wognin, Sebastien Niamké**
Biotechnology Laboratory, Biosciences Faculty, Felix Houphouët Boigny University, 22 BP 582 Abidjan 22
**Corresponding author: Dr. Otchoumou Kraidy Athanase, Biotechnology Laboratory, Biosciences Faculty, Felix Houphouët Boigny University, 22 BP 582 Abidjan 22, Email: tchoumou2@yahoo.fr, Phone: +225 07 79 72 06*
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1 ABSTRACT

The feed restriction study involved two groups of rabbits; the first was subjected to two-week restriction and the second group to four-week restriction. Feed restriction consisted of reducing the daily feed by 10, 20, 30 and 40% over different periods. The results showed that a 10% restriction of daily feed allows a growth (group 1: 2370.63 ± 100.41 g; group 2: 2175.11 ± 51.78 g) similar to that of the control (2465.54 ± 127.57 g) which received a complete daily feed. It also improves their survival (100%). This study also revealed that feed rationing in rabbits induces growth, which is a function of the duration of the restriction. The feed costs evaluated (D 10: group 1: 7476.92 FCFA and group 2: 7030.40 FCFA against 7598.48 FCFA for the control batch) showed that this 10% reduction of daily feed constitutes a gain for any breeder wishing to do an intensive activity.

2 INTRODUCTION

Rabbit farming is classified among non-conventional breeding in Côte d'Ivoire (FAO, 2009). This breeding is not commonly practiced although it is very significant potential in terms of productivity and nutritional value of the rabbit. One of the reasons for this state of affairs is in its high production cost linked largely to the high price of industrial feed for rabbits made from cereals and soybean meal. In order to cope with this observed brake, several research works on the distribution of different fodder plants have been carried out in several African countries such as Nigeria (Adeyemo *et al.,* 2014), Benin (Koutinhouin *et al.,* 2014), in the Democratic Republic of Congo (Katunga *et al.,* 2012) and in Côte d'Ivoire (Kimsé *et al.,* 2013; Kouakou *et al.,* 2016). As this sector of activity is also very recent, its development requires not only an adequate selection and crossing of rabbits, but also in-depth studies in the field of nutrition which is often the basis of the morbidity and mortality observed in rabbits. post-weaning young rabbit whose control could contribute to the food security of populations by the availability of rabbit meat (Akoutey and Kpodekon, 2009). However, food accounts for 70% of total production costs. Therefore, reducing food costs becomes a major concern for small herders in hot countries (Dahouda *et al.,* 2013). In addition, post-weaning mortality and morbidity constitute a major problem that undermines this promising sector of activity, which must be tackled in Côte d'Ivoire. Therefore, several solutions are recommended including feed restriction. Regarding feed restriction, it has long been considered a technique for controlling the health (morbidity) of fattening rabbits (Gidenne *et al.,* 2012). In

addition, limiting feed ingestion in rabbits reduces their growth rate and can degrade their slaughter yield (Gidenne *et al.,* 2009b; Travel *et al.,* 2011). In Côte d'Ivoire, very little information exists on feed restriction in young rabbits after weaning. Thus, in order to control post-weaning feeding, this study was conducted to assess the influence of feed restriction on the growth, the health of the young rabbits and on the cost of feeding.

3 MATERIAL AND METHODS

The study was conducted in a rabbit farm in the district of Abidjan. Forty-Five (45) California Breed rabbits (684 g and 6 weeks old) were put under the trial. The rabbits are placed individually in cages, equipped with feeder and waterer, mounted in series. An acclimation period to the experimental conditions of 7 days was observed. During this phase of acclimation, the animals were daily fed ad libitum with the commercial feed « ivograin ». A common diet (ivograin) meeting the basic nutrient requirements of fattening rabbits was used in both trials. At the beginning of each test, the rabbits were divided into 2 homogeneous groups. Thus, the first group rabbits were subjected to a restriction of two weeks and the second group to four weeks of restriction. The dietary restriction applied in this study consisted of a ration reduction of 10, 20, 30 and 40% over different periods (two and four weeks) (D10, D20, D30, D40). After the different periods of restriction, the rabbits were fed to satiety. Water was always available ad libitum throughout the trials. This study lasted eight weeks.

3.1 Growth performance and health status: In both trials, 45 rabbits were used to determine growth performance. For this purpose, feed consumption and live weight were individually recorded at 49, 77 and 105 days of the trial period. Thus, daily food consumption, daily weight gain and feed conversion rate were calculated for these different periods. In addition, all animals were monitored for mortality and morbidity twice daily. The morbidity rate was the percentage of live animals with one of the following symptoms: prostration, swollen belly, relatively low body weight, diarrhoea or mucus under the cage. The presence of a morbid animal was counted only once, although signs of morbidity appeared several times on the same animal.

3.2 Statistical analysis: All the data taken from this study were subjected to the analysis of variance (ANOVA) using SPSS 17 software. The variations in means were separated using the Duncan Multiple Range Test (Duncan, 1955)

4 RESULTS AND DISCUSSION

The results showed when the reduction of the daily feed increases, the growth of the rabbits was slow as reflected by the average daily weight (Figure 1). Thus from 49th to the 77th day of breeding, for a restriction of 2 weeks, the average daily weight of rabbits fed with D 10 (33.50 ± 1.24 g / d) and D 15 (33.69 ± 1.10 g/d) are similar ($P \geq 0.05$) and the same trend is true for the rabbits fed with D 20 (30.82 ± 0.90 g/d) and D 25 (31.25 ± 1.85 g/d) rations. For the period from 77th to 105th day and from 49th to 105th day of rearing this parameter differs between batches of rabbits ($P \leq 0.05$). However, the average daily weight of the rabbit fed with D10 does not differ from that of the control batch over the entire rearing period (Figure 1). As for the 4-week restriction, the average daily weight varies significantly from one batch to another ($P \leq 0.05$) but, as previously, the average daily weight of the D10 lot does not differ from that of the 77th to 105th day control batch also over the entire rearing period (Figure 5). This is explained by the fact that the 10% daily ration is close to that of the control and higher than that of the other lots also subject to the restriction. This result confirms that of Gidenne *et al.,* (2009) who according to them a feed restriction beyond 10% decreases the growth rate of rabbits. The comparative evolution of the average daily weight obtained during the two tests is such that

between the period of the 49th to 77th day of rearing, the average daily weight of the rabbit fed D 15, D 20 and D 25 for each test, are significantly different (P≤ 0.05), but from 77th to 105th day, the average daily weight values for these two tests drop while keeping the same direction of evolution as before. This could be explained by the fact that among young rabbits, there is a period during which whatever the mode of feeding, the rabbits grow quickly and beyond this period, the growth is slow (Matics *et al.* 2008). The intake of granulated feed in a restricted way to the rabbit had an impact on the consumption indices of the latter. The average values of the consumption indices recorded in the period from the 49th to the 77th day ranged between 3.30 ± 0.69 and 3.80 ± 0.81 and those from the 77th to 105th ranged between 5.49 ± 0.95 and 7.55 ± 0.89 (Figure 3). The first low 3.30 compared to the last 7.55 could be explained by the fact that the animals use the feed that contributes strongly to their growth while the higher values implied certainly important ingestion but a slow growth during the period of 77th - 105th day. However, the consumption indices obtained in the period from 49th to 77th day compared to the interval of consumption indices (3.9-4) defined by Lounaouci – Oyed (2001) could be qualified as better. The consumption indices in North Africa are generally above 4.5 (Rossilet, 2001). Then, the consumption indices obtained in the present study between 77th and 105th day of breeding, are acceptable. At the end of this study, the batch of the D 10 diet just like the control batch does not record any mortality (Table 2). The causes of mortality and morbidity of the rabbits in the first weeks of the experiments would not be due to coccidiosis because an anticoccidial treatment was given to all the subjects before the start of the tests (Table 2). They would be caused by ingestion of excess feed (70-110g) either by the young rabbit, or by a very severe restriction (20 and 40% death in batch D25 respectively for groups 1 and 2). These cases of morbidity in the present study, which are largely followed by the subject's recovery, could be due to the beneficial effects of feed restriction. This hypothesis could be verified through the results of the work carried out by Romero et al. (2010) that the reduction in fattening mortality in restricted rabbits is due to the decreased flow of nutrients reaching the cecum. In addition, Gidenne and Feugier (2009) found that a food restriction of 20% increased the cecal concentration of volatile fatty acids (from 65.9 to 84.8 mmol / l when the feed restriction varied from 0 to 40%). The acidified cecal content (5.64 - 5.99) while increasing the bacterial fibrolytic activity (5.0 vs 10.6 µmol reducing sugar / g DM per hour). This acidification could help reduce the caecal number of potential harmful bacteria, as some of them, such as *Clostridium perfringens*, are sensitive to acidic pH (EFSA, 2005). The feed costs or feed charges (CFA francs) of the rabbits subject to various restrictions as well as that of the control were determined for each test at the end of the experiments in order to assess its economic impact over the entire period of the experiment (Table 3). These charges varied depending on the restriction rate. They are lower (6264.40-7030.40 F CFA) than the load recorded by the Control batch (7598.48 F CFA). This is because during the entire experiment the batch received the full amount of feed required. From this observation, we can effectively conclude that food restriction in breeding, in the case of rabbits regardless of its duration, reduces the financial charges injected into the feed of the animals concerned. This result is confirmed by Yakubu et al. (2007) who consider feed restriction as a means to reduce production costs. Likewise, Gidenne et al. (2009 b) conclude from their work that restricting the ingestion of rabbits after weaning is a feeding strategy commonly practiced in France due to a reduction in feed costs. To this end, feed restriction is a gain for any breeder wishing to exercise intensive activity. Certainly, the restriction has a beneficial effect on the growth and health of rabbits. However, for better production of rabbit meat in Côte d'Ivoire, further studies on food restriction should be considered in order to precisely and rigorously determine the time required as well as the period of food restriction in rabbits.

Table 1: Final body weight of rabbits after 56 days of breeding

	Feed restriction duration	Diets				
		D 10	D 15	D 20	D 25	Control
Initial body weight		684.38 ±50.26	683.44±68.73	682.37±72.81	684.33±71.27	690±70.67
Final body weight	2 weeks	2405.11±85.29	2202.57±92.47	2101.56±62.05	1997.06±76.77	2465.54±144.28
	4 weeks	2370.65±100.41	1972.57±107.21	1861.56±107.24	1767.06±89.16	2465.54±144.28

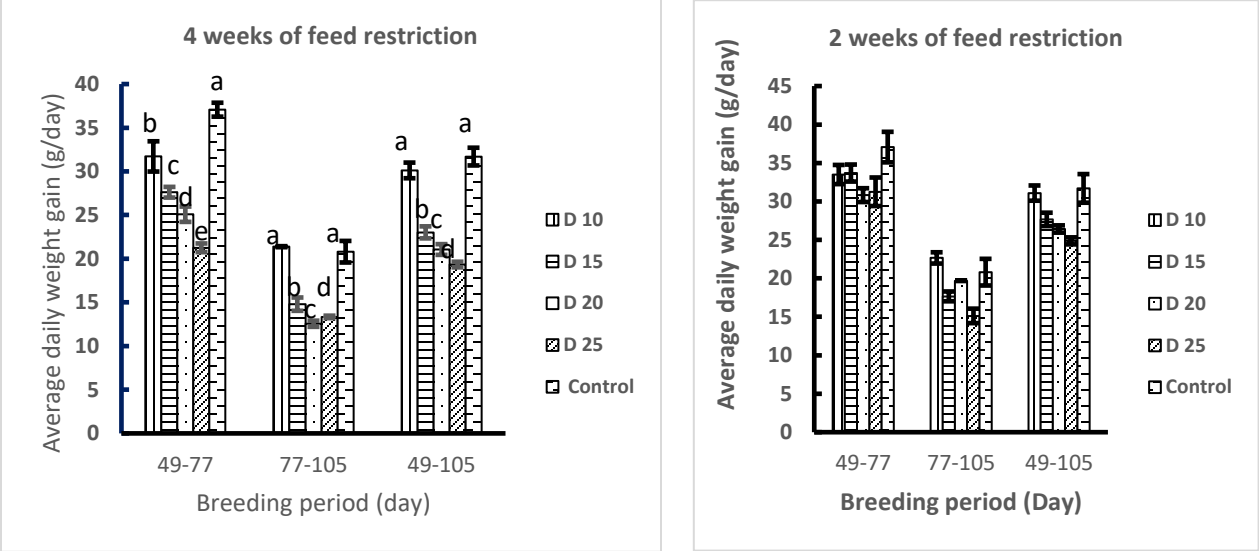

Figure 1: Variation in weight of rabbits subjected to feed restriction during 8 weeks of rearing

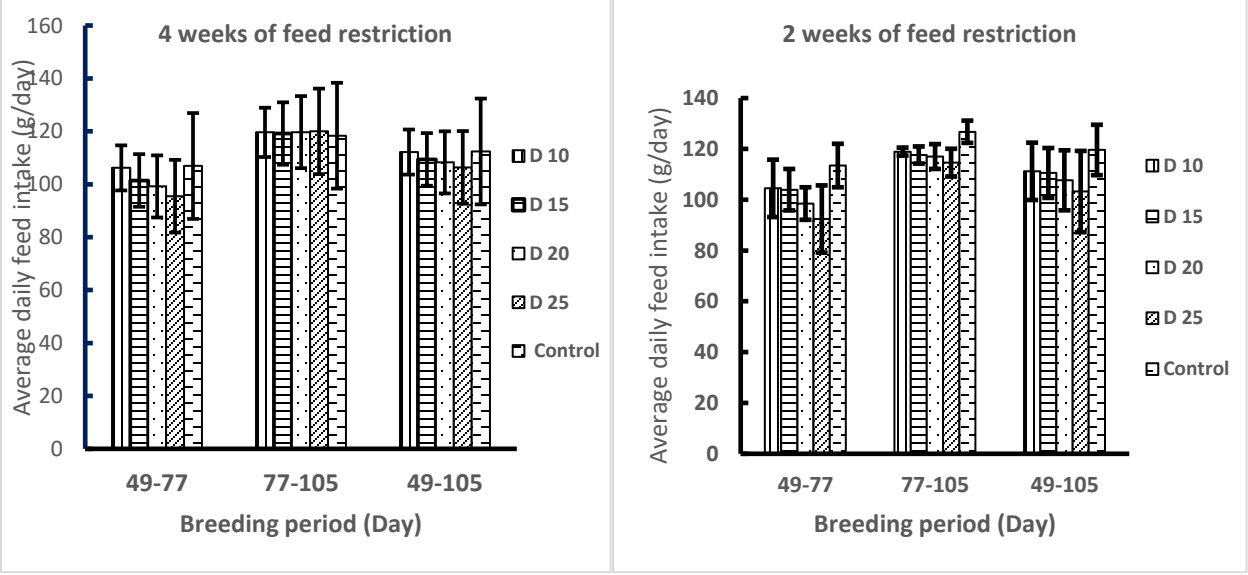

Figure 2: Variation in feed intake of rabbits subjected to feed restriction during 8 weeks of rearing

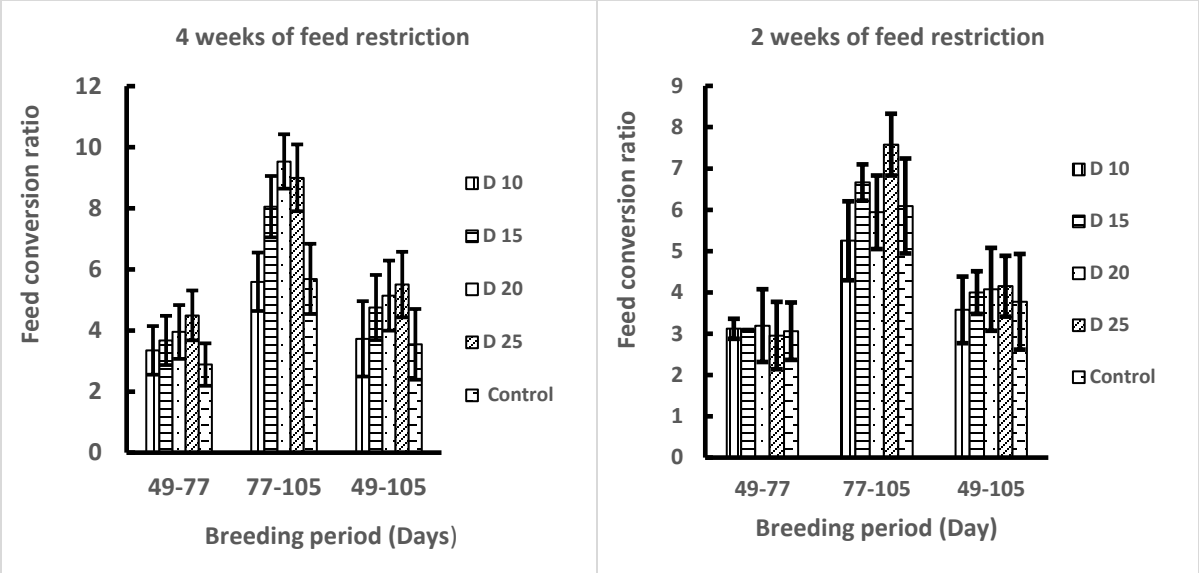

Figure 3: Variation in feed conversion ratio of rabbits subjected to feed restriction during 8 weeks of rearing

Table 2: Summary of health monitoring of rabbits subjected to feed restriction during 8 weeks of breeding.

		Diets				
		D 10	**D 15**	**D 20**	**D 25**	**Control**
	Breeding period	*2 weeks of feed restriction*				
Morbidity (%)	49th-77th day	0	0	0	20	40
	77th-105th day	40	20	20	20	20
	49th-105th day	40	20	20	40	60
Survival (%)	49th-77th day	100	100	100	100	100
	77th-105th day	100	80	80	80	100
	49th-105th day	100	80	80	80	100
		4 weeks of feed restriction				
Morbidity (%)	49th-77th day	0	0	20	20	40
	77th-105th day	0	20	0	20	20
	49th-105th day	0	20	20	40	60
Survival (%)	49th-77th day	100	100	80	100	100
	77th-105th day	100	80	80	80	100
	49th-105th day	100	80	80	60	100

Table 3: Average feed intake costs of rabbits subjected to feed restriction during 8 weeks of rearing

Breeding period	Cost of feed intake (F CFA)				
	D 10	D 15	D 20	D 25	Control
	2 weeks of feed restriction				
49th-77th day	3457.02 d	3264.72c	3157.54b	3002.52a	3566.48e
77th-105th day	4019.90 a	4015.95a	3997.72a	3977.98a	4032a
49th-105th day	7476.92d	7280.67c	7155.26b	6980.5a	7598.48e
	4 weeks of feed restriction				
49th-77th day	3043.24d	2946.19c	2676.24b	2459.96a	3566.48e
77th-105th day	3987.16b	3930.44a	3905.86b	3804.44a	4032a
49th-105th day	7030.40d	6876.63c	6582.10b	6264.40a	7598.48e

Values are means ± SD (n = 3). Means in the same row having different superscripts are significantly different ($P < 0.05$) and values in the same row with same superscript are not significantly different ($P > 0.05$). The values in parentheses represent the standard deviation.

5 CONCLUSION

A 10% restriction of 120g of granulated feed allows for similar (acceptable) growth of a young rabbit to that of the Control who received all 120g of feed. This restriction of 10% of the daily ration also improves the health of the young rabbits and has made it possible to reduce the cost of production.

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