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Influence of Feed Manipulation on the Growth of Dutch Rabbit

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Abstract

The phenomenon of compensatory growth has been relatively applied and successful both experimentally and due to natural occurrences common among ruminant. Rabbit a pseudo-ruminant was therefore chosen in this study to determine the influence of feed manipulation on the growth of Dutch rabbit by restriction of feeds at age 8, 12 and 16 weeks of age. Thirty-Six bunnies were randomly allocated to four (4) feeding regimes were 185g of diet was continually fed for 12 weeks except for manipulation by restriction. The feed manipulation were (R_0) no restriction, (R_1) Restriction from the 16^{th} weeks (R_2) Restriction from the 12^{th} weeks and (R_3) Restriction from 8^{th} weeks of age. Each treatment was replicated thrice with 3 rabbits per replicates. The rabbits were tagged and their body weight were taken weekly from weaning to maturity. Data collected was subjected to analysis of variance. Results obtained showed that feed manipulation influenced body weight at 3^{rd} and 4^{th} months in post weaning rabbits. However, from the study , it can be suggested that feed restriction shortly after weaning leads to weight lost as observed in (R_3) were body weight gain was significantly ($P \leq 0.05$) reduced in Dutch rabbits restricted from feed at 2 - 3 month post weaning age. Thus feed manipulation by restriction should be discouraged at early post weaning age in growing Dutch rabbits. Although, growing rabbit adapts very well to an intake limitation strategy, without any aggressive behaviour for congener. In conclusion, restriction strategies could improve profitability of rabbit breeding, but they should be adapted to any specific breeding situation, according to the market, feed, prices, etc

Keywords: Compensatory Growth, Manipulation, Feed Restriction, Bunnies.

Introduction

It is a common practice in commercial rabbit production to feed young rabbit to appetite directly after weaning and during growth periods with diets high in energy and protein level. Rabbits for meat production generally reach 50 to 55 per cent of their adult weight by 9 to 10 weeks of age, but the cost of feeding growing rabbits is a deep gnaw on the income of commercial rabbit farmers mostly when the appetite at the growing stage is almost insatiable. One possible nutritional strategy of reducing feed cost is to restrict feed intake of animals especially in early stage of life owing to the fact that animals after some periods of restriction will be able to compensate for their losses when subjected to generous feeding. Therefore, feed restriction could be exploited in the feeding regimen of rabbits, especially in periods of inadequate supply of concentrates and forages (Yakubu et al., 2007), although, it has to be considered as a stress condition and applied with attention when other stressors occur (Bovera et al., 2008). It is suggested that the growth of young rabbits should be restricted by limiting their feed supply during the growth period (Eiben, et al., 2010). Reduction of energy intake by limiting feeding time is also recommended in the case of fat adults and after weaning (Tag El Den et al., 1988;)

Dutch rabbits are light breeds of rabbits with an average body weight of 1.6-2.5 kg. The coat fur is short, with a characteristic white with black, blue or brown, chocolate, steel or tortoise. The head is rounded and full with a short neck, making the head set close to the shoulders. They are well-furred with clear bright eyes, free of spot and discoloration in the iris. Their toe nails are acute while their fur is dense and short (Odeyemi 1998).The front of the face, body, and the back feet are white; the rest is colored. It possesses an upright ear. Their food consumption annually by adult is 8 ounces per pound, with a total water intake capacity of 50 – 100ml per pound or 100-200ml per kg body weight. Dutch rabbits are good natured and quite sociable with a great personality. They have a delicate skeletal structure that makes up about 7 – 8% of the rabbits total body weight.

Growth can be defined as a correlated increase in the total mass of the body at definite interval in a way characteristic of the species. It could be Hyperplasia which is growth associated with increase in the number of cells or Hypertrophy which is associated with size increment of cells (Olomu, 1995). The phenomenon of compensatory growth has been a subject of great interest to researchers as reviewed by Goodchild and Mtenga (1982). This is because proper utilization of

compensatory growth can result into economic benefits as producers are interested to keep their animals alive at the lowest production cost at all seasons. At birth and weaning there may be a temporary deceleration of growth as an animal switches from one source of nutrients to another, except for a slight acceleration at puberty. Subsequent growth maintains a steady average velocity until the terminal deceleration as animals reach their mature size.

Feed manipulation through feed restriction (FR) is a type of management procedure where the amount of feed animals would consume to eliminate hunger sensation is limited. It could be quantitative or qualitative. Qualitative FR means feeding nutritionally deficient diet *ad libitum*, while quantitative FR is the feeding of limited amount of nutritionally balanced diet.). Feed manipulation on the basis of feed restriction to animal under quantitative and qualitative feed restriction exhibited compensative growth as a consequence of increased food intake after restricted feeding (Rizzi, et al., 2008). Feed manipulations in some breeds of rabbits have often been reported in respect to compensatory growth. According to Gidenne et al., (2012), quantitative feed restriction leads to slower growth but feed conversion (FC) is improved, particularly when the rabbits are again fed freely, as compensatory growth occurs. Specific emphasis can be laid on the economic benefits of feed manipulations. It has been reported that in order to reduce the excessive fatness of young does, restricted feeding during pregnancy is frequently applied to obtain uniformity in their body weights, to avoid fattening and high mortalities around parturition (Romme et al., 2001), and to increase voluntary intake at the beginning of the lactation period, and to allow a long productive life (Partridge, et al., 1986). Tumova et al., (2012) reported that digestibility of nutrients improved only in restriction periods .Consequently, when food was provided *ad libitum* to previously restricted does, weight gain was significantly higher than that in the *ad libitum* group (Bispham, et al., 2003; Petrere, et al., 1993). Also, performance index was significantly higher for groups of rabbits on feed restriction (Yassein et al., 2011) and to assess the effect which age at pneumonectomy has on pulmonary compensatory growth, when male New Zealand White rabbits underwent left pneumonectomy or sham thoracotomy at 10, 18, or 26 weeks of age (Abeer et al., 2012).

Growing rabbit can be maintained satisfactorily on diets consisting of 100 to 200g green roughage and 40 to 60g concentrate mixtures for maximum production (Ranjhan 1980). It is very difficult among farmers and rabbit enthusiast to

continually depend on green forages due to the fact that there is dearth of information on the type of forages rabbit relish. However, the rabbit breeds with rapid growth are prone to be overfed during the last four –week period. Consequently, over fat does at first kindling are more sensitive to dietary fluctuations. Adequate supplementation remains a principal hurdle to be overcome for rabbit rearing in Nigeria. Supplementary concentrates are based on mixtures of locally available protein feedstuffs (cottonseed cake, soybean cake, fish meal) and energy (wheat bran, rice brain, maize) (Roy, 2002). Concentrates are presented either as commercial mixtures or homemade feeds. The high cost of commercial feeds and the irregular supply of protein feedstuffs for compounding home-made feeds by farmers confounds with other constraints to complicate the nutritional adequacy of diets for rabbits. Rabbit farmers practice the inclusion of multiple protein-rich feedstuffs as sources of protein in their home-made concentrate feeds. This practice does not only have an increased effect on the cost, but leaves the farmers with limited options in the manipulation of feed formulae in the absence of some of these feedstuffs in the market (Mbanya, 2005).

Also, the validity of feed manipulation in the concept of feed restriction has yielded some result. According to Abeer (2008) when rabbits were given a quarter of their daily requirement of feed mixture, they grew to the same size as did those fed normally, within 7 days of re-feeding, producing a saving of 850 g feed mixture per head. However, starvation at 65 to 80 days resulted in death when body weight decreased by 30 to 31% (Gidenne et al., 2009). It was noticed that during feed restriction muscular tissues were quantitatively reduced in thickness but not in length (Tumova et al., 2006). Growth compensation due to a single period of starvation is based on maintenance of the histology and cytology of muscle sets capable of differentiating, regenerating and growing during re-feeding. Feed restriction during the first half of gestation did not affect the maternal body weights, whereas feed restriction during the second half of gestation was accompanied with significant reduction in the weights of does at the 4th week of pregnancy and at kindling. It is also convenient that breeding animals particularly in the tropical climate should not gain excessive weight because of the heat. Thus, Suddeth (2002) suggested decreasing the feeding frequency as a management practice to alleviate the effect of heat on the animals. Under tropical conditions, it is therefore logical to adopt a restricted system of feeding. However, one of the main advantages of limiting post-weaning intake of the rabbit is to reduce the mortality and morbidity rate due to digestive disorders (particularly epizootic

rabbit enteropathy syndrome). The consequences for animal welfare are debatable, as feed restriction probably leads to hunger, but it reduces the incidence of digestive troubles after weaning (Gidenne , 1993).

MATERIALS AND METHOD

The study was carried out between May and August 2012 at the rabbitry unit of the Delta State Polytechnic Ozoro, It is located at lat. 5°30′ and 5°45′ N, longitude 6°51′ and 6°13′ E. with a temperature 28 °C maximum and 26 °C minimum (hottest month) temp.22 °C (coldest month), rainfall 2,000mm-3,000 mm /annual (Wikipedia, 2010). The maximum and minimum daily temperatures during the study period ranged between 27°C to 36°C and 20°C to 26°C, respectively while the relative humidity ranged between 57 to 91% (Delta State Polytechnic Ozoro Meteorological Station, Ozoro, 2009). Delta State, Nigeria. America Dutch crossbred weaned rabbits aged 4-6 weeks with initial live weight of 245g-300g were used in the study during a period of 12 weeks. The weaned rabbits were obtained from eleven dams of already existing stocks at the polytechnic farm with litter ranging from 2-5. Each litter was allowed to stay with their dam till weaning at 4 weeks. The weaned rabbits were tagged and housed three per cage, having six cells each measuring 55cm in length 50cm in width and 55cm height, provided with weighted earthen ware pots for provision of water and cemented concrete feeding troughs as feeders. Housing and other management practices were maintained similar for all treatment groups.

Table 1: Proportions of feed ingredients in experimental diets

Composition on as-fed basis, g/kg	
Maize	350
Wheat bran	510
Groundnut cake	115
Soybean cake	0
Fish meal	0
Palm oil	10
Bone meal	10
Table salt	5
Calculated analyses (g/kg as fed basis)	
Crude protein	161
Digestible energy	3.00

(Mcal/kg)	
Dry matter	861
Crude fiber	65
Ether extract	44
Ash	420

Animals and Management

The diets were iso-caloric and iso-nitrogenous, and were made in batches and offered at a daily rate of 100g/animal. In addition each animal was given a daily allowance of 200g of elephant grass (*Pennisetum Spp*) and *Tridax* to boost the fiber content of the diet. The grasses were bundled, wrapped and placed in the cage. Water was provided *ad-libitum*. All feeds were offered in the morning after collection of the left over's except for those cages with animals that were restricted of feeds at particular period.

Data Collection

Feeds offered and the left-overs were recorded daily for each treatment to determine intake. Live weight change and feed intake were recorded weekly until the end of the trial. Feed conversion was determined by dividing the unit of feed intake by that of live weight gain. The nutrient content of the diets was predicted from data in animal feed composition tables (McDonald et al 1973).

RESULT AND DISCUSSION

A major component of compensatory growth by animals given abundant feed after period of restriction is increased feed intake. Performance response of rabbit to high and low plane of nutrition during the first eight weeks of the experiment was as expected, even till 12^{th} and 16^{th} weeks of others before restriction and was mainly due to higher nutrient intake and utilization which resulted in increase growth rate (Owen, 1976). During the growth period, between 9^{th} and 22^{nd} weeks, rabbits on R_3 showed slower growth rate than those restricted at 12^{th}, 16^{th} as well as control respectively. The reasons for lower daily gains for rabbits on R_3 may be because the feed offered at that period could not meet their nutrient requirements for rapid growth and development. Orskov et al., (1976) observed that when animals change from high to low dietary regime, they tend to eat less and grow slower than those on high plane of nutrition. Winchester and Ellis (1987) commented that animals on low plane of nutrition grow at a rate appropriate to their physiological age rather than chronological age. The present study confirms

this statement in that rabbit on low plane nutrition grow at slower rate as can be inferred from their percentage weight gain. Rabbit that were deprived using high fibrous feed (Brewer dried grain) at 8, 12 and 16 weeks of age respectively till 22weeks. There were significant difference in manipulating methods applied with restriction at 8 weeks of age till sexual maturity as compared with unrestricted (control) counterparts while those restricted at 12 and 16 weeks of age showed so much difference as the control.

Mean, standard deviation and coefficient of variation of body weight of rabbits at different age as shown in table 1 showed that rabbits at different ages tend to be similar with different of only less than 8 percent between the highest, lower body weight in subsequent ages compared with the control and those restricted at latter age R_1 when there was no more active growth and the lowest value. The mean value obtained for weight at weaning 4 weeks and at 22 weeks which were 296g and 1175g respectively were slightly lower than those (350-400g) 1150-2000g respectively reported by Aduke and Olukosi,(1990) and mean value of weight at weaning 204g and at 22 weeks 1671g (Orheruata and Ekgoegbe,2009). Feed restriction did not affect the live weight at the age of 84 days, and compensatory growth was recorded in quantitative restricted rabbits. Only in the week immediately after restriction was daily weight gain higher by 40% than in the rabbits fed ad libitum. The lack of compensatory growth in time restricted rabbits seemed to be limited by lower feed consumption. Restriction regimens did not significantly (P <-0.05) decrease daily feed intake and feed efficiency. The digestibility of nutrients improved only in restriction periods. Slaughter parameters were not significantly influenced. Mortality and shedding of oocysts of parasites were not affected by feeding methods.

Conclusion

This means that restriction at very early age is not economically as this period is the most critical period of their lives in terms of growth and development when the epiphysial of the animal is yet to fuse, hence need adequate nutrition for effective growth. Therefore for a prospective farmer who embarks on manipulating growth through feed restriction stands the benefit of feeds savings and hence economic returns when properly planed. Such a feeding strategy thus represents a double benefit in terms of feed costs and lower losses of young rabbits

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Table 1: Mean, standard deviation and coefficient of variation of body weight or rabbits at different ages.

Age(week)	N	Mean (g)	Stand. Dev.	C/V (%)
4	36	296.25	82.25	27.69
5	36	365.41	95.92	26.25
6	36	460.83	116.99	25.39
7	36	517.92	122.47	23.65
8	36	572.92	142.26	24.83
9	35	609.58	164.06	26.91
10	34	686.82	178.79	26.03
11	34	765.00	188.55	24.65
12	34	834.09	182.93	21.93
13	34	866.82	208.56	24.04
14	34	930.91	219.72	23.60
15	34	952.27	240.06	25.21
16	32	1005.91	242.54	24.11
17	32	995.91	278.95	28.01
18	32	1048.57	302.64	28.90
19	32	1084.76	300.82	27.73
20	31	1114.84	286.44	25.70
21	31	1131.58	316.51	28.00
22	30	1175.26	312.68	26.61

Table 2: Effect of manipulation method on growth at different post weaning ages in rabbits

Treatments	Weaning	1 months	2 months	3 months	4 months
R_0	313.33^{ab}	661.67^{a}	916.70^{a}	1146.70^{a}	$133.8.40^{a}$
R_1	255.00^{b}	528.33^{a}	818.30^{a}	1093.30^{a}	1216.00^{ab}
R_2	250.00^{b}	521.67	808.30^{a}	936.70^{ab}	988.00^{bc}
R_3	366.67^{c}	580.00^{a}	772.58^{a}	767.50^{b}	867.50^{c}

Table 3: percentage weight gain at different manipulation phases

Growth phase	R_0	R_1	R_2	R_3
Weaning to 1month post	54.15%	50.62%	51.01%	34.43%

Weaning				
1 - 2 months post Weaning	31.64%	35.22%	35.46%	27.07%
2- 3 months post Weaning	20.06%	25.15%	13.71%	-0.65%
3 -4 months post Weaning	17.45%	12.68%	8.53%	10.53%

Table 4: Performance data of growing rabbits restricted on feed manipulation

	R_3	R_2	R_1	R_0
Wt gain g/day	14.2^{a}	13.9^{a}	14.1^{a}	12.5^{a}
se	1.9	2.0	1.9	2.3
Feed conversion	4.7^{a}	4.7^{a}	5.1^{a}	5.2^{a}
se	2.0	2.2	2.0	2.4
T. F intake g	3637^{abc}	3278^{c}	3669^{ab}	3967^{abc}
se	127	127	127	155
D.F.intake (g)	64.9^{abc}	58.5^{c}	65.5^{abc}	70.8^{ab}
se	2.2	2.2	2.2	2.8

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