



Short Communication

Feed Intake during the Reproductive Resting Period in Adult Cage-bred Wild Rabbits (*Oryctolagus cuniculus algirus*)

Pedro González-Redondo^{1*}

¹Departamento de Ciencias Agroforestales, Escuela Técnica Superior de Ingeniería Agronómica, Universidad de Sevilla, 41013 Sevilla, Spain

*For correspondence: pedro@us.es

Abstract

This study was aimed at estimation of voluntary feed intake of wild rabbits (*Oryctolagus cuniculus algirus*) during reproductive resting period in context to their intensive breeding in game farms. To this end, 20 adult outdoors cage-bred wild rabbits were fed *ad libitum* with a commercial feed for domestic rabbits containing 16.5% crude protein, 16.5% crude fiber and 2,340 kcal digestible energy/kg dry matter. The average feed intake was 65.3 ± 12.1 g/day, without differences between sexes ($P > 0.05$). The dry matter consumed relative to live weight was $6.0 \pm 0.9\%$ without differences between sexes ($P > 0.05$), but being higher ($P < 0.05$) to that described for adult domestic rabbits. Average daily feed intake was higher ($P < 0.01$) in heavier wild rabbits, but the proportion of dry matter consumed relative to live weight did not change ($P > 0.05$) with the animals' live weight, suggesting that this value is constant throughout maturity. This information is useful for feed formulation and supply in the game farming of wild rabbits of the *O. c. algirus* subspecies. © 2013 Friends Science Publishers

Keywords: *Oryctolagus cuniculus algirus*; Game farming; Feed consumption; Commercial feed

Introduction

The intensive breeding of wild rabbits (*Oryctolagus cuniculus*) in game farms has developed in recent times, especially in Mediterranean countries, due to the growing need to restock wild populations decimated by myxomatosis and rabbit viral hemorrhagic disease (González-Redondo, 2003). Due to this recent development, breeding technology and cages for the domesticated breeds are used for the wild rabbit, often with low productivity (González-Redondo, 2010) and welfare jeopardizing (González-Redondo and Zamora-Lozano, 2008; González-Redondo, 2009). Contrary to what happens with other game species like partridge and pheasant bred in captivity is more widespread (González-Redondo *et al.*, 2010) and specific feeds are available in the market (Berardelli *et al.*, 1987; González-Redondo, 2011), in the case of the wild rabbit there are no commercial feeds specifically formulated for its needs. For this reason, game farms typically use commercial feeds for meat breeds (González-Redondo, 2003). The domestic rabbit feeding behaviour is well known (Méndez and Villamide, 1989; Cheeke, 1995; Lebas *et al.*, 1996; Njidda and Isidahomen, 2011). It is also known that the feeding behaviour in controlled laboratory conditions using exclusively rabbit feed compound both for the wild rabbit (Prud'hon and Goussopoulos, 1976; Prud'hon *et al.*, 1978; Reyne *et al.*, 1979; Reyne and Goussopoulos, 1984) and for the crossbreed between this and domestic breeds (Reyne *et al.*,

1980). However, research on feed consumption of wild rabbits kept in game farm handling conditions is lacking. In the absence of specific literature, the aim of this work is to contribute towards furthering knowledge about voluntary feed intake in adult cage-bred wild rabbits during the reproductive resting period, in conditions similar to those of intensive game farms in which wild rabbits are bred in cages.

Materials and Methods

Experimental Farm and Animals

The trial was carried out using 20 ($n = 10$ males and $n = 10$ females) adult wild rabbits (*Oryctolagus cuniculus algirus*) aged two to six years, born and bred in cages from parents captured in the Southern Iberian Peninsula. The animals were kept in individual cages built with wire mesh and measuring 38×51 cm at the base, located outdoors on an experimental farm in Córdoba province (Andalusia, Spain), with geographic coordinates $37^{\circ}53'$ N and $4^{\circ}47'$ W at an altitude of 180 m above sea level with a southern exposure.

The experiment was conducted in the second half of January, during the animals' reproductive resting period, in cold weather with average daily temperatures of $10.2 \pm 2.4^{\circ}\text{C}$ (mean \pm SD). The mean of minimum daily temperatures was $7.0 \pm 3.4^{\circ}\text{C}$ and the mean of maximum daily temperatures was $13.8 \pm 2.1^{\circ}\text{C}$. Relative humidity was $88.0 \pm 6.4\%$. Only natural light was used, with a photoperiod of 10 h day length.

Experimental Feed and Data Measured

The animals were fed *ad libitum* with a balanced commercial standard feed for domestic rabbits, which came in the form of pellets 3.5 mm in diameter and no more than 15 mm in length. The analytical constituents of the feed were 89.8% dry matter, 16.5% crude protein, 16.5 crude fiber, 3.5% crude fat, 9.7% ash, and contributed 2,340 kcal Digestible Energy/kg DM. The rabbits had been fed this complete feed for six months prior to the commencement of the study. Drinking water, provided *ad libitum*, was taken from the main drinking water supply system of the city where the farm was located.

The experiment consisted in measuring the individual feed consumption for each rabbit in a period of 14 days in order to quantify the average daily feed and dry matter intake with regard to sex and weight. Each rabbit was individually weighed at the outset of the experiment.

Statistical Analysis

Difference between sexes for the variables measured was analyzed by mean of Student's *t*-tests. Associations between the variables measured and the rabbits' live weight were analyzed using Pearson's correlation coefficients. The analyses were carried out with SPSS 15.0 (SPSS Inc., 2006).

Results and Discussion

Table 1 shows the wild rabbits' live weight and feed consumption by males and females. The animals showed significant weight differences between the sexes ($P < 0.01$), females being heavier than males. In spite of this, no significant differences were observed between sexes either in average daily feed intake ($P > 0.05$) or in the average amount of dry matter consumed daily in relation to live weight ($P > 0.05$). This was probably due to the fact that the animals were in their reproductive resting period and it is well known that, in domestic rabbits, the most intense differences in feed intake are due to changes in the reproductive status (Lebas, 1975). Thus, in females feed consumption decreases at the end of the gestation period and is minimal during the two days prior to kindling, then increasing progressively up to a peak 20-30 days after the

birth and decreasing afterwards (Lebas, 1975).

The adult wild rabbits in this trial consumed an average daily amount of feed [65.3 g/day (ranging from 50 to 85.9 g/day)], which was higher to that (40 to 60 g/day) described by Prud'hon and Goussopoulos (1976) and 35 to 50 g/day by Prud'hon *et al.* (1978) for nine-month-old wild rabbits kept in cages and fed with a similar feed. This difference may be due not so much to the fact that our rabbits were older, since they weighed slightly less, but to their being exposed to temperatures lower than 15°C, which causes an increase in feed intake corresponding to the increased energy requirements caused by higher thermoregulation expenditure (Méndez and Villamide, 1989). In contrast, in the experiences of Prud'hon and Goussopoulos (1976) and Prud'hon *et al.* (1978), the animals were kept at 20°C, well within the rabbit thermoneutrality interval (Ferré and Rosell, 2000) in which feed intake to meet maintenance requirements is minimal (Méndez and Villamide, 1989).

The average daily feed consumed by the animals in this trial was much lower than that described for domestic rabbits, since in adult specimens of lines and breeds currently used in industrial rabbit breeding for meat production the figure is above 150 g/day when fed *ad libitum* (Méndez and Villamide, 1989; Lebas *et al.*, 1996; Salma *et al.*, 2004). Even daily feed intake in growing rabbits of domestic breeds is well above 100 g (El-Tohamy and El-Kady, 2007). This is due to the much bigger size of rabbit meat breeds, which is around 4 kg live weight (Lebas *et al.*, 1996), in the order of four times that of the wild rabbits used in the present study.

The average daily feed intake for the wild rabbits in this experiment was also lower than that observed by Reyne *et al.* (1980) in crossbreeds obtained from crossing wild rabbits with domestic New Zealand White rabbits, known to ingest an amount of 72 to 120 g/day feed intermediate between that for wild rabbits and domestic breeds (Reyne *et al.*, 1980).

For both sexes, the average proportion (6%) of dry matter consumed daily relative to live weight in the wild rabbits of the experience deviated significantly from 5.5% (Student's *t*-test: $t = 2.42$, $P = 0.026$), which is the value described for adult of meat rabbit breeds (Méndez and Villamide, 1989). The slightly higher ($P < 0.05$) value found

Table 1: Live weight and feed intake for adult cage-bred wild rabbits (*Oryctolagus cuniculus algirus*)

Variable		Males (n = 10)	Females (n = 10)	Both sexes (n = 20)	Difference between sexes
Live weight (g)	Mean±SD	917.3 ± 56.1	1044.5±116.0	980.9 ± 110.1	$t = -3.12$,
	Minimum	839	851	839	$P = 0.006$
	Maximum	1013	1209	1209	
Feed intake (g/day)	Mean±SD	60.8 ± 12.4	69.8±10.4	65.3 ± 12.1	$t = -1.76$,
	Minimum	50.0	55.4	50.0	$P = 0.095$
	Maximum	85.9	83.2	85.9	
Dry matter intake (% relative to live weight)	Mean±SD	5.9 ± 1.0	6.0±0.9	6.0 ± 0.9	$t = -0.27$,
	Minimum	5.2	4.9	4.9	$P = 0.790$
	Maximum	8.2	7.4	8.2	

Means ± standard deviation

in our case study could be attributed to genetic and phenotypic differences between domestic breeds and the wild subspecies used in the current study (Branco *et al.*, 2000), but more likely to higher thermoregulation demands due to cold weather conditions.

There was a significant association (Pearson's correlation coefficient: $r = 0.596$, $n = 20$, $P = 0.006$) between the rabbits' weight (both sexes considered together) and the daily feed intake, so that heavier animals consumed more feed. Nevertheless, there were no significant differences (Pearson's correlation coefficient: $r = 0.032$, $n = 20$, $P = 0.893$) in the average proportion of dry matter daily intake relative to live weight in rabbits of different live weights, which seems to confirm that, once rabbits reach maturity, as in our case, the rate between dry matter feed intake and live weight stabilizes, so that those individuals that consume more feed in absolute terms do not ingest a higher proportion of dry matter relative to their live weight, but the higher absolute intake is due to their bigger size.

Due to the relevance of the captive breeding of wild rabbits in game farms, further research will be useful to elucidate the evolution of feed intake during the growing period of the juvenile rabbits, and also according to the reproductive status and throughout the seasons for wild rabbits kept outdoors in conditions similar to those of game farms.

Conclusion

In conclusion, during the reproductive resting period, cage-bred wild rabbits have an average daily feed intake of 63.5 g/day that represents an average amount of 6% of dry matter consumed daily in relation to live weight, without difference between sexes.

References

- Berardelli, C., M.C. Benassi and M. Gubellini, 1987. Indagine sulle caratteristiche di mangimi commerciali per volatili selvatici di interesse faunistico-venatorio. *Rivista di Avicoltura*, 6: 29–36
- Branco, M., N. Ferrand and M. Monnerot, 2000. Phylogeography of the European rabbit (*Oryctolagus cuniculus*) in the Iberian Peninsula inferred from RFLP analysis of the cytochrome b gene. *Heredity*, 85: 307–317
- Cheeke, P.R., 1995. *Alimentación y Nutrición Del Conejo*. Acribia, Zaragoza, Spain
- El-Tohamy, M.M. and R.I. El-Kady, 2007. Partial replacement of soybean meal with some medicinal plant seed meals and their effect on the performance of rabbits. *Int. J. Agric. Biol.*, 9: 215–219
- Ferré, J.S. and J.M. Rosell, 2000. Alojamiento y patología. In: *Enfermedades Del Conejo*, Vol. 1, pp: 167–210. Rosell, J.M. (ed.). Mundi-Prensa, Madrid, Spain
- González-Redondo, P., 2003. Contribución al conocimiento de la producción del conejo silvestre (*Oryctolagus cuniculus*) en cautividad estricta. *Ph. D. Thesis*, Universidad de Córdoba, Córdoba, Spain
- González-Redondo, P., 2009. Injuries in cage-bred wild rabbits (*Oryctolagus cuniculus*) caused by the size of the orifices in the cage floor. *Arq. Bras. Med. Vet. Zool.*, 61: 1246–1250
- González-Redondo, P., 2010. Maternal behaviour in peripartum influences preweaning kit mortality in cage-bred wild rabbits. *World Rabbit Sci.*, 18: 91–102
- González-Redondo, P., 2011. Chick growth in red-legged partridge (*Alectoris rufa*) fed with two commercial feeds. *J. Anim. Vet. Adv.*, 10: 875–877
- González-Redondo, P., M. Delgado-Pertñez, S. Toribio, F.A. Ruiz, Y. Mena, F.P. Caravaca and J.M. Castel, 2010. Characterisation and typification of the red-legged partridge (*Alectoris rufa*) game farms in Spain. *Span. J. Agric. Res.*, 8: 624–633
- González-Redondo, P. and M. Zamora-Lozano, 2008. Neonatal cannibalism in cage-bred wild rabbits (*Oryctolagus cuniculus*). *Arch. Med. Vet.*, 40: 281–287
- Lebas, F., 1975. *Le Lapin de Chair: Ses Besoins Nutritionnels et Son Alimentation Pratique*. ITAVI, Paris, France
- Lebas, F., P. Coudert, H. De Rochambeau and R.G. Thébault, 1996. *El Conejo. Cría y Patología*. FAO, Rome, Italy
- Méndez, J. and M.J. Villamide, 1989. Manejo de la alimentación. In: *Alimentación Del Conejo*, pp: 133–151. De Blas, C. (ed.). Mundi-Prensa, Madrid, Spain
- Njidda, A.A. and C.E. Isidahomen, 2011. Hematological parameters and carcass characteristics of weanling rabbits fed sesame seed meal (*Sesamum indicum*) in a semi-arid region. *Pak. Vet. J.*, 31: 35–39
- Prud'hon, M. and J. Goussopoulos, 1976. Comportement alimentaire du lapin de garenne en captivité. *Ann. Zootech.*, 25: 407–410
- Prud'hon, M., J. Goussopoulos and Y. Reyne, 1978. Comportement alimentaire du lapin de garenne élevé en captivité. II.- Modifications induites par un décalage des périodes d'éclairage. *Ann. Zootech.*, 27: 101–106
- Reyne, Y., Y. Carles and J. Goussopoulos, 1980. Comportement alimentaire du lapin croisé Neo-zelandais × garenne age de douze semaines. In: *Proc. 2nd World Rabbit Congress, April 1980*, Vol. 2, pp: 111–118. WRSA, Barcelona, Spain
- Reyne, Y. and J. Goussopoulos, 1984. Caractéristiques du système endogène responsable des rythmes circadiens de la prise de nourriture et d'eau de boisson chez le lapin de garenne: étude en lumière permanente et en obscurité permanente. In: *Proc. 3rd World Rabbit Congress, April 1984*, Vol. 2, pp: 473–480. WRSA, Rome, Italy
- Reyne, Y., J. Goussopoulos and M. Prud'hon, 1979. Comportement alimentaire du lapin de garenne élevé en captivité. III.- Etude des rythmes d'ingestion d'aliment et d'eau en lumière permanente. *Ann. Zootech.*, 28: 159–164
- Salma, U., A.G. Miah, Y. Akter, Z.H. Khandaker and A. Reza, 2004. Effect of different levels of protein supplementation on reproductive performance of rabbit does under tropical condition. *Int. J. Agric. Biol.*, 6: 794–796
- SPSS Inc., 2006. *Manual Del Usuario De SPSS Base 15.0*. SPSS Inc., Chicago, USA

(Received 20 July 2012; Accepted 17 September 2012)