

COMPARATIVE DIGESTIBILITY OF NUTRIENTS IN GROWING RABBITS AND BREEDING DOES

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Abstract - In order to study the effect of physiological status on nutrient digestibility, balance trials were carried out with 49-day old rabbits (10 per diet) and pregnant lactating primiparous does (8 per diet) in a 2 x 3 experimental design. The young rabbits and the reproductive does were divided into 3 groups and were given the following diets : M (moderate energy diet), S (starch-rich high energy diet) and F (high energy diet with inclusion of vegetable fat). Apparent digestibility of dry matter, organic matter, nitrogen, crude fibre and digestible energy (DE) content were significantly higher in growing rabbits than in reproductive does mainly in the case of diet M (DE: 10.58 vs 9.92 MJ/kg DM).

INTRODUCTION

Digestibility measurements are usually performed with growing rabbits. The extrapolation of the results obtained with young animals to other classes of rabbit is often debated. Some authors have determined nutrient digestibility of diets both in young fattening rabbits and in non-reproductive adult rabbits (e.g., LEBAS, 1973 ; PARTRIDGE, 1980; PÉREZ *et al.*, 1994). But, experiments using simultaneously growing rabbits and breeding does are scarce and lead to conflicting results (MAERTENS & DE GROOTE, 1982 ; XICCATO *et al.*, 1992 ; DE BLAS *et al.*, 1995). The aim of this work was to investigate the influence of physiological status on digestive efficacy by comparing young rabbits with pregnant lactating does.

MATERIAL AND METHODS

Table 1 : Ingredient and chemical composition of the experimental diets

Diet	M	S	F
<i>Ingredient (%)</i>			
Wheat	19,9	19,0	19,0
Dehydrated lucerne meal	20,8	20,8	20,8
Soybean meal	15,9	16,8	16,8
Sunflower meal	15,0	15,0	15,0
Beet pulp	11,4	11,4	11,4
Maize starch	-	14,0	7,4
Wheat straw	14,0	-	-
Wood cellulose	-	-	3,6
Sunflower oil	-	-	3,0
Minerals and vitamins	3,0	3,0	3,0
<i>Chemical analysis</i>			
Dry matter (%)	89,6	88,6	89,4
Ash (% DM)	9,3	8,7	8,7
Crude protein	20,7	20,7	20,3
Ether extract	2,0	2,0	5,2
Crude fibre	19,4	14,0	17,2
NDF	38,9	26,5	30,1
ADF	24,4	16,3	19,9
ADL	5,2	3,8	3,8
Gross energy (MJ/kg DM)	18,05	17,82	18,53

Diets

Ingredient composition and chemical analysis of the experimental diets are given in Table 1. Diet M was formulated to have a moderate digestible energy (DE) content, while the other diets (S and F) were formulated to have a similar high DE content. Each diet included the same proportion (86%) of a common basis containing wheat, alfalfa, beet pulp, soybean and sunflower meal. Diet S differed from diet M by substituting 14 points of wheat straw for maize starch, whereas diet F contained both maize starch (7.4%) and vegetable fat (3% sunflower oil).

Digestibility trial

Nutrient digestibility was determined on growing rabbits and breeding does according to the European reference

method (PEREZ *et al.*, 1995). The growing rabbits (Californian x New Zealand White) were allotted (ten per diet) by taking into account the sex, the origin of litters and the weight of animals (avg live wt: 1149 ± 22g). They were kept individually in metabolism cages and were given *ad libitum* the experimental diet from 42 days of age. After a 7-day period of adaptation, total faecal excretion was collected daily in plastic bags and stored at -18°C for 4 consecutive days. The primiparous does (Californian x New Zealand White, INRA line 1067) were remated within 12 hours after parturition. Does were allocated to the experimental groups (eight per diet) according to their litter size (avg: 10.5 ± 0.2) and their live weight at parturition (avg: 3600 ± 22g). They were caged individually with a controlled light/dark cycle (16 h / 8 h) and had free access to the experimental diet from parturition until the end of the experiment. They were allowed to suckle their pups in a separated cage once a day for 10 min. Faecal output was recorded during the third week of pregnancy.

Chemical analyses

Dry matter (DM), ash, crude protein (CP), ether extract and Weende crude fibre (CF) contents were determined according to the methods of AOAC (1990). Gross energy (GE) was measured by an isoperibol bomb calorimeter. Cell wall fractions (NDF, ADF, ADL) were determined by a sequential procedure including an amyolytic pretreatment.

Statistical methods

The experimental data were subjected to analyses of variance by using the GLM procedure of SAS (SAS, 1988). Statistical model included the effects of diet, physiological status and the interaction between diet and physiological status.

RESULTS AND DISCUSSION

Dry matter intake (DMI) was influenced by both diet and physiological status (Table 2). DMI was two times higher for reproductive does than for growing rabbits ($P < 0.001$). Significant interaction between diet and physiological status occurred for feed intake, because DMI of does receiving diet M was 23 % higher than that recorded in the other groups (S and F), whereas DMI of growing rabbits was less affected by the energy dilution of the diet (+8% in group M vs others).

As expected, apparent digestibility of dry matter (dDM), organic matter (dOM) and DE content were significantly reduced in group M (Table 2). GE digestibility was 4% lower with diet F than with diet S owing to the higher fibre content of the former, while GE content of diet F was 4% higher due to the inclusion of vegetable fat. Therefore, DE content of these two diets was similar.

Digestibility of all dietary constituents was higher ($P < 0.05$) in young rabbits than in reproductive does. This result does not support the findings of DE BLAS *et al.* (1995) but shows good agreement with a previous study comparing growing rabbits and lactating does (MAERTENS & DE GROOTE, 1982). The most important effect was recorded for apparent digestibility of crude protein (dCP: 72.4 vs 69.5%, $P < 0.01$). In the same way, LEBAS (1979) and HULLAR & LACZA-SZABO (1988) observed a decrease in CP digestibility from the 3rd week of gestation.

The interaction between diet and physiological status was significant ($P < 0.05$) for the digestibility of crude protein (CP) and approached the level of significance for the digestibility of the other nutrients except that of crude fibre. In fact, young rabbits showed a better digestibility than breeding does mainly with diet M for most of the nutrients. Digestibility of crude fibre was higher in growing rabbits than in reproductive does regardless of the diet. This result disagrees with the observation of DE BLAS *et al.* (1995) but is consistent with the findings of XICCATO *et al.* (1992).

Table 2 : Effects of diet and physiological status on nutrient digestibility ¹

Diet		M	S	F	Mean	Diet	Physiol. Status	Interaction
DM intake (g/d)	young	126,0 ±5,1 (n=10)	116,3 ±4,6 (n=8)	117,1 ±5,0 (n=9)	120	0,001	<0,001	0,030
	doe	276,9 ±14,2 (n=8)	221,9 ±15,8 (n=7)	228,4 ±6,7 (n=8)	243			
dDM (%)	young	59,93 ±0,86	69,91 ±0,53	67,56 ±0,62	65,9	<0,001	0,022	0,060
	doe	56,25 ±0,79	70,22 ±0,79	66,17 ±1,12	64,2			
dOM (%)	young	60,09 ±0,84	70,42 ±0,54	67,71 ±0,66	65,7	<0,001	0,024	0,076
	doe	56,48 ±0,80	70,67 ±0,80	66,30 ±1,16	64,2			
dGE (%)	young	58,61 ±0,90	68,49 ±0,58	66,94 ±0,68	64,7	<0,001	0,024	0,119
	doe	54,94 ±0,84	68,40 ±0,87	65,73 ±1,19	63,0			
dCP (%)	young	72,27 ±1,36	71,22 ±1,18	73,85 ±1,05	72,4	0,008	0,004	0,022
	doe	65,62 ±0,82	71,25 ±1,10	71,59 ±1,29	69,5			
dCF (%)	young	15,92 ±1,61	19,13 ±1,46	17,74 ±2,09	17,6	0,130	0,032	0,832
	doe	10,49 ±1,24	16,12 ±2,60	14,36 ±3,46	13,7			
DE (MJ/kg DM)	young	10,58 ±0,16	12,21 ±0,10	12,41 ±0,13	11,73	<0,001	0,025	0,125
	doe	9,92 ±0,15	12,19 ±0,15	12,18 ±0,22	11,43			

¹ Means ± standard error

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Comparaison de l'utilisation digestive des nutriments chez le lapin en croissance et la lapine en reproduction - Cinquante-quatre bilans digestifs au total ont été mis en oeuvre selon la méthode européenne standardisée à la fois chez des lapins en croissance de 49 jours d'âge (10 par régime) et chez des lapines primipares simultanément gravides et allaitantes (8 par régime) pour étudier l'incidence du stade physiologique sur l'efficacité de la digestion. Trois régimes différant par leur valeur énergétique ou la nature de l'énergie ont été introduits dans la comparaison : un régime (M) à teneur modérée en énergie et 2 régimes (S et F) à plus forte concentration énergétique supplémentés par de l'amidon de maïs ou de l'huile de tournesol. La digestibilité apparente de la matière sèche, de la matière organique, de l'azote, de la cellulose brute et la teneur en énergie digestible sont significativement plus élevées chez le lapin en croissance que chez la lapine en reproduction principalement dans le cas du régime M (ED: 10,58 vs 9,92 MJ/kg MS).
