EFFECT OF MASH FEED ON THE PERFORMANCE OF GROWING RABBITS.

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ABSTRACT

This trial shows the effect of an increasing proportion of "mash" (crude raw materials) on growth performance of rabbits between 32 and 70 days old. Four diets were compared, including an increasing proportion of mash (0, 15, 20 and 25%). Nutritional composition of diets was similar. Feed intake was restricted between 32 to 56 days and thereafter animals were fed *ad libitum*. During the restricted period (32-56 d), weight gain and feed conversion ratio were impaired significantly as the proportion of mash increased (e.g. for weight gain: 48.1, 46.0, 45.1 and 43.9 g per day for the diets with 0, 15, 20 and 25% of mash, respectively). During the *ad libitum* period (56-70 d), a compensatory growth took place for the 3 "mash" diets , but it was not enough to compensate the lower growth during the restricted period. On the whole period, the diets with mash impaired significantly the feed conversion ratio from 2.75 (control) to 2.96 (25% mash).

Key words: Rabbit, Feed presentation, Mash, Performance, Growing.

INTRODUCTION

Some feed mill industries adapt the physical presentation of their feeds to farmers' expectations in term of transparency and costs: mash presentation ("crude" raw materials) in ruminant, mixture of cereals for poultry, etc. It thus seems important to check if a different presentation from the pellet could be used for the rabbit feeding. More especially as many industrial tools exist and can mix crude raw materials with or without incorporation of long fibre and/or liquids. Respect to feed presentation, the literature explains the influence of the crushing of the raw materials on the performances by comparing the same feed presented as pellet or coarsely crushed. Other authors demonstrated the interest of the pelleted form compared to the flour presentation on rabbit feed intake, growth and feed conversion (Candau et al., 1986; Harris et al., 1983; Fomunyam et al., 2000; Kpodekon et al., 1998). A first study (Rochon and Goby, 1986) showed a deterioration of the growth and feed conversion with diets based on raw materials crushed or not, respect to pelleted diets, but with different nutritional levels between diets. In another work (Goby and Rochon, 1990), with diets having a similar nutritional value (pellet vs. crude raw materials in grains and flour), the authors did not observe differences on rabbit performance.

From these elements, it seems useful to study the absence of flour and a maximum level of crude raw materials, while keeping the same nutritional level. This was the aim of our study, in which the percentage of "mash" was limited to 25% of the diet.

MATERIALS AND METHODS

Animals and experimental diets

The test was carried out at the experimental station of Saint Symphorien (72, France) during the summer period. A total of 672 young rabbits (Hyplus), weaned at 32 d of age, were divided into 4 homogeneous batches. Each batch was composed of 24 cages with 7 young rabbits (the allocation was

done according to the individual weight at weaning and weight of the litter). Animals were controlled from 32 to 70 d of age.

The four diets were formulated to have the same nutritional values, by combining a pelleted part and a "mash" part in variable percentages (Table 1). Diet 1 was a 100% pelleted feed A (control), while the other diets (Diet 2, Diet 3 and Diet 4) presented a pelleted part (85, 80 and 75% pelleted feed B, C and D, respectively) and a "mash" part (15, 20 and 25%, respectively, constituted of different raw materials). Diets 1 and 3 are presented in pictures (picture 1).

Table 1: Theoretical values of the experimental diets (feed + mash)

Diet	1	2	3	4
Feed A (%)	100			
Feed B (%)		85		
Feed C (%)			80	
Feed D (%)				75
Wheat gluten feed		6.0	8.0	10.0
Sunflower meal		5.7	7.6	9.5
Alfalfa		3.0	4.0	5.0
Aroma feed		0.3	0.4	0.5
Total (%)	100	100	100	100
digestible energy (kcal/kg)	2352	2352	2349	2349
Fat (%)	4.3	4.3	4.4	4.4
Starch (%)	8.1	8.1	8.1	8.1
Crude protein (%)	14.8	14.8	14.8	14.8
Crude cellulose (%)	18.0	18.0	17.9	17.9
Digestible lysine (%)	0.44	0.44	0.44	0.44

Table 2: Composition of the pelleted feeds (%)

Feed	A	B	C	D
Wheat	3.0	3.4	3.74	4.0
Wheat gluten feed	16.0	11.8	10.3	8.2
Soybean meal	2.8	3.3	4.0	4.3
Rapeseed meal	2.0	2.4	2.5	2.7
Sunflower meal	18.0	14.5	12.4	10.6
Alfalfa	16.1	15.4	13.7	13.3
Sugarcane molasses	4.0	4.7	5.0	5.33
Fibre mix	12.2	14.4	17.0	18.2
Beet pulp	20.0	23.5	24.6	26.3
Soya oil	1.95	2.29	2.50	2.67
Amino acids & minerals. premix	1.95	2.31	2.26	2.40
Aroma premix	2.0	2.0	2.0	2.0

The crude raw materials were selected according to their physical characteristic and their capability to be eaten such as they are (size, hardness).

Picture 1: Diet 1 and diet 3 pictures.

The four pelleted feeds (Table 2) were formulated to have isonutritive diets (pelleted feed + mash). No antibiotics or coccidiostatics were used in feed or water during the test. The animals were restricted to 85% of the theoretical *ad libitum* intake (for a feed with 2350 kcal of digestible energy per kg) up to 56 days, and then they were fed *ad libitum*.

Experimental controls

The rabbits were weighed collectively by cage at 32, 43, 56 and 70 days of age. The feed consumption was also measured by cage for the periods 32-43, 43-56 and 56-70 days. Control of wasting (the feed not consumed, which were still in feeding dishes) and scraping (the feed thrown in pits) was also done. Mortality was recorded daily. A control of hardness and durability of the pelleted feed was carried out.

Statistical Analysis

Data of growth, feed consumption and feed conversion ratio were subjected to variance analysis including the diet as a fixed effect and the weaning weight as a covariate, according to a GLM procedure with the software SPSS. The differences between diets were analyzed with Sidak-test 5%. Mortality was analyzed by χ^2-test.

RESULTS AND DISCUSSION

The chemical analysis (moisture, protein and crude fibre) of feed A to D were in conformity with the expected values. The variations of hardness and durability were minor between the different feeds: 1.7 points for hardness and 1.9 points for durability (Table 3)

Table 3: Chemical analyses of the diets and physical analyses of the pelleted feed

Diets	A	B	C	D
Humidity (%)	10.3	10.4	10.5	10.4
Crude Protein (%)	14.9	15.3	15.1	15.6
Crude cellulose (%)	19.3	19.6	18.3	18.4
Hardness (Kahl) of pelleted feed A,B,C,D	10.6	8.9	9.4	10.0
Durability (Quick test Sabe) of pelleted feed A, B, C, D	94.1	93.3	92.8	92.2

The trial was performed under good sanitary conditions: mortality in each experimental group was low (between 0.6 and 1.8%) and the differences were not significant (table 4). During the restricted period (32-56d), the weight gain averaged 45.8 g/d and was significantly different with 48.1, 46.0, 45.1 and 43.9 g/d respectively for diets 1, 2, 3 and 4 (table 4). During the *ad libitum* period, the differences were not significant. For the whole period (32-70d), the weight gain decreased significantly with the increase of the mash percentage inclusion (47.9, 47.1, 46.4 and 45.5 g/d for diets 1, 2, 3 and 4, respectively). And also, residual variability of weight gain was lower during the restricted period (coefficient of variation from 2.3 to 2.8%) than during the *ad libitum* period (from 6.8 to 11.6%).

Table 4: Growth performances and intake according to the percentage of mash in the diet

		diet 1 0% mash	diet 2 15% mash	diet 3 20% mash	diet 4 25% mash	Weaning weight effect	Diet effect	CVr (%)
Live weight	32 d (g)	962±60	963±60	963±60	962±61			
	43 d (g)	1546±63a	1513±63b	1498±71bc	1482±66c	P<0.001	P<0.001	1.4%
	56 d (g)	2117±56a	2066±57b	2046±64b	2014±57c	P<0.001	P<0.001	1.3%
	70 d (g)	2782±91a	2753±88ab	2725±110bc	2692±88c	P<0.001	P<0.001	2.5%
Weight gain	32-43d (g/d)	53.1±1.3a	50.0±1.7b	48.7±2.6bc	47.3±2.0c	NS	P<0.001	3.9%
	43-56d (g/d)	43.9±1.7a	42.5±1.6b	42.1±1.8b	40.9±1.5c	P<0.001	P<0.001	3.3%
	32-56d (g/d)	48.1±1.1a	46.0±1.3b	45.1±1.2b	43.9±1.2c	P=0.006	P<0.001	2.5%
	56-70d (g/d)	47.5±4.0	49.0.1±4.4	48.0.5±5.6	48.4±3.3	P=0.020	NS	9.0%
	32-70d (g/d)	47.9±1.7a	47.1±2.0ab	46.4±2.0bc	45.5±1.4c	NS	P<0.001	3.8%
Feed intake	32-43 d (g/d)	89.0±0.0	89.0±0.2	89.0±0.0	89.0±0.0			
	43-56 d (g/d)	124.7±0.6	124.5±0.0	124.5±0.0	124.7±0.6			
	32-56 d (g/d)	108.3±0.3	108.2±0.1	108.2±0.0	108.3±0.3			
	56-70 d (g/d)	172.1±11.9a	181.1±10.0b	179.6±13.5ab	180.5±10.5b	P<0.001	P<0.001	5.8%
	32-70 d (g/d)	131.7±4.5a	135.1±3.7b	134.5±5.0ab	134.9±3.8b	P<0.001	P=0.012	2.9%
Feed conversion ratio	32-43d	1.68±0.04a	1.78±0.06b	1.83±0.11b	1.88±0.08c	NS	P<0.001	4.3%
	43-56d	2.85±0.11a	2.93±0.11b	2.96±0.13b	3.05±0.10c	P<0.001	P<0.001	3.4%
	32-56d	2.25±0.06a	2.36±0.06b	2.40±0.07b	2.47±0.07c	P=0.005	P<0.001	2.7%
	56-70d	3.63±0.18	3.70±0.19	3.73±0.31	3.74±0.13	NS	NS	5.8%
	32-70d	2.75±0.07a	2.87±0.08b	2.90±0.09b	2.96±0.08c	P<0.001	P<0.001	2.5%
Morbidity (%)		0.6	0.6	3.0	1.8		NS	
Mortality (%)		1.8	0.6	0.6	0.6		NS	

(Mean ± Standard deviation)

As expected, feed intake during the restricted period was the same for the different groups. But, it seems that feed intake during both the *ad libitum* and the whole period was higher for "mash" diets (2, 3 and 4) than for "all pelleted" diet (1). A weak wasting was observed on diets 3 and 4 starting from the *ad libitum* feeding: 5 cages in diet 3 and 9 cages in diet 4. This wasting was also weak in quantity: for diet 3, an average of 204 g/cage during the *ad libitum* period which represent 2.1 g/d/rabbit, and for the diet 4, 161 g/cage or 1.6 g/d/rabbit. This wasting did not deteriorate the feed intake compared to diet 2.

The feed conversion ratio was significantly different between diets during the restricted period but not during the *ad libitum* period. On the whole period, the differences were significant: 2.75, 2.87, 2.90 and 2.96 g/g for the diets 1, 2, 3 and 4, respectively.

During the restricted period, the animals consumed all the food distributed, whatever the presentation, and without wasting. Feed efficiency was better with the diet 1, certainly because the animal valued more the pellets than the mash mixture (although the diets had the same nutritional value and intake). When fed *ad libitum* with a mash presentation, the animal increased its ingestion whatever the percentage of mash. The rabbit has a different behaviour according to the physical presentation of the diet, as it is shown in trials comparing pellets versus flour (Lebas, 1973). In this trial, the raw materials were also pelleted, the hypothesis could be a different efficiency according to pellet size, hardness or palatability of raw materials. During the *ad libitum* period, the feed efficiency was still better with pelleted feed (lower intake for a similar growth). These results agreed with Çalişkaner *et al.* (1996), where a pelleted form was compared to the same diet with fresh alfalfa added. In a general way, feed efficiency was always better for the pellets, and several explanations could be advanced: the pelleted feed could have a better digestibility because of crushing of the constitutive raw materials, which will decrease the size of the particles. The rabbit may also have a selective intake behaviour when a mash mixture diet is provided which could induce a modification of the nutrient intake. However, these are suppositions, since no observation of the ingestion behaviour was performed in the present study.

CONCLUSIONS

In conclusion, the whole pellet presentation of the diet lead to the better performance of growing rabbits, compared with the use of a percentage of the diet in mash presentation, particularly with respect to feed efficiency.

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