FIELD BEANS AND BREWER'S GRAINS AS PROTEIN SOURCE FOR GROWING RABBITS IN ALGERIA: FIRST RESULTS ON GROWTH AND CARCASS QUALITY

Lounaouci–Ouyed G.[1]*, Lakabi-Ioualitene D.[1], Berchiche M.[1], Lebas F.[2]

[1]Université Mouloud Mameri, Laboratoire de Biochimie Analytique et Biotechnologies BP 17 RP, 15000 Tizi-Ouzou, Algeria
[2]Cuniculture, 87A Chemin de Lasserre, 31450 Corronsac, France
*Corresponding author: lgouyed@yahoo.fr

ABSTRACT

Three isonitrogenous (crude protein: 16.9% as fed) and isofibrous diets (crude fibre: 9.7%) were manufactured in Algeria: one control diet containing 10% soya meal (SM10diet) and two experimental diets based on 30% field beans, supplied with *dl*-methionin (FB30 diet) or 30% brewer's grains (BG30 diet), as main and alternative protein source, in complement to dehydrated alfalfa and wheat bran. Diets were distributed *ad libitum* to 3×17 commercial growing rabbits from weaning (35 days, 565 g) until 84 days of age (slaughter) in order to study growth and slaughter performances. All rabbits were caged individually. The protein source had a significant effect on average growth rate, which was significantly higher for SM10 and FB30 than for BG30 animals (31.5 on average vs. 27.1 g/d), but not on feed conversion ratio (3.2 on average). The slaughter weight at 84 days of age was correlated with the protein source: the consumption of SM10 and FB30 diets permitted rabbits to reach a higher slaughter live weight (2080 g on average) than the BG30 group (1877 g). Nevertheless, the dressing percentage (67.4% for the cold carcass on average) and the muscle/bone ratio (6.3) were similar for the three groups of rabbits. In conclusion, brewer's grains, and especially field beans, seem to be suitable alternative source of proteins (in total substitution to soya meal) in Algerian conditions of production of balanced diets for growing rabbits.

Key words: Rabbit, Field beans, Brewer's grains, Growth performance, Slaughter traits.

INTRODUCTION

Rabbit breeding is one of activities which have future in Algeria. Since few years, several actions have been carried out in order to develop this production, but the high price of food is the more discouraging problems for breeders. In this way, balanced diets by using the maximum of available local raw materials are being evaluated (Berchiche *et al.*,1996 a and b, 1999 and 2000). Among these raw materials, field beans and brewer's grains seems to be very interesting as alternative protein source (Carabaño and Fraga, 1992). Possibilities of field beans utilization in rabbit feeding have already been demonstrated (Seroux, 1984; Berchiche *et al.*, 1988, 1995) and in a previous study, Berchiche *et al*. (1999) incorporate field beans up to 30% no being detected any significant deterioration of growth performance.

Data about the utilization of brewer's grains in the rabbit's diets are scarcely reported (Lebas *et al*., 1996; Maertens and Salifou, 1997; Berchiche *et al.*, 1999). However, this fibrous by-product, containing a significant amount of protein, seems to be suitable for rabbit feeding in the Algerian situation. In addition, the brewer's grains is actually big and competitive.
The aim of the present work is to study the possibility of utilisation of field beans or brewer's grains (up to 30%) as main protein source in balanced diets for growing rabbits.

MATERIALS AND METHODS

Diets

Three diets were formulated and pelleted in an Algerian manufacturing unit of feeding stuff. The control diet (a classical formula used in Algeria as mixed diet for rabbit production) was based on 10% of soya meal (SM10 diet) and the 2 experimental diets were based on 30% of field bean grains, (FB30 diet) or 30% of dehydrated brewer's grains (BG30 diet), in complement of alfalfa and wheat bran. The FB30 diet was supplied with 0.16% *dl* methionin, because proteins of the field beans are mainly characterized by a low sulphur-amino-acids content (Berchiche *et al*., 1995). The diets were formulated using tables of feedstuffs composition (INRA, 1989), in order to substitute soya meal by field bean or brewer's grains as main source of protein (Table 1). The target composition for diets was 17% crude protein, about 13% crude fibre and 10.5 MJ digestible energy/kg as fed, according to INRA (1989) recommendations for growing rabbits.

Animals and experimental design

Fifty one mixed-sex commercial rabbits (a line obtained in Algeria from French hybrid rabbits imported 20 years ago and maintained in a closed population since that time), weaned at 35 d of age and weighing 565 g on average, were assigned according to weaning weight and litter origin to the three experimental groups (17 rabbits/diet). Rabbits were placed into wire mesh individual cages in flat deck disposition and were fed *ad libitum* the experimental diets, without transition with mother's diet, until the end of the experiment, at 84 d of age. Fresh water was always available. Live weight and feed consumption were controlled weekly, and mortality was controlled daily. Rabbit cages were set up in one of the rooms of the Tizi Ouzou University facilities during the months of May and June. Temperature was not artificially controlled and varied in the range 19-26°C. Artificial light program was 7 h/24 h but humidity was not measured.

Slaughter performances

At the end of the trial (at 12 weeks of age), 8 rabbits/diet were slaughtered in order to measure skin, full digestive tract, hot and cold carcass weight and kidney fat according to Blasco *et al*. (1993), with the noticeable difference that the head was not skinned. Cold carcasses (24 h at +4°C) were presented with head (not skinned), thoracic content (heart, lungs), liver, kidneys and extremities of the legs with their skin, according to local market tradition.

Chemical analyses

Analyses were made at the Station de Recherches Cunicoles (INRA Research Centre, Castanet Tolosan, France). The following chemical analyses were carried out on feed according to AOAC (1984): dry matter (24 h at 103°C), ash (5 h at 550°C), gross energy (adiabatic calorimeter PARR, Moline, Illinois, USA), crude fibre (Weende method). Nitrogen was determined according to the DUMAS combustion method using the Leco auto-analyzer (model FP-428, Leco Corp., St Joseph, MI, USA) and converted to crude protein using the factor 6.25.

Statistical analyses

Statistical analysis was made with the SAS-STAT package (SAS, 1998). The variance analysis was performed with the experimental treatment (diet) as single fixed effect. When the treatment effect was significant ($P<0.05$), differences between means were determined using the Duncan Test (SAS, 1998).

RESULTS AND DISCUSSION

Nutritional composition of diets

The average protein content of the 3 diets was within the values recommended for growing rabbits (16.9 vs. 15-17) (Lebas, 2004). The substitution of soybean meal by dehydrated brewer's grains induced a reduction of lysine (0.69 vs. 0.74%) and a SAA (0.47 vs. 0.52%) proportions in the brewer's grains diet, but not in the field beans diet (Table 1). The fibre level was similar for the 3 diets and on average lower than that expected (9.7 vs. 12.9%). The fibre level was also clearly lower than those recommended for growing rabbits (12 to 14% as fed) (Lebas, 2004). This unexpected low fibre content may be related to a too low level of fibre in the employed batch of dehydrated alfalfa.

Table 1: Composition of the three experimental diets

	Diets		
	SM10	FB30	BG30
Ingredients (%)			
Soya meal 44	10	-	-
Vicia Faba	-	30	-
Brewer's grain	-	-	30
Hard wheat bran	36	29	25
Dehydrated alfalfa	30	25	25
Maize	20	-	-
Barley	-	13	15
Mineral and Vitamins[1]	4	2.84	5
dl-Methionine	-	0.16	-
Chemical composition (as fed)			
Dry matter (%)	91.8	91.4	92
Crude protein (%)	16.7	17.5	16.5
Crude fibre (%)	09.2	09.3	10.6
Ash (%)	9.4	8.0	8.5
Gross Energy (MJ /kg)	16.6	16.7	16.9
Lysine calculated (%)[2]	0.74	0.88	0.69
SAA calculated (%)[2]	0.52	0.61	0.47

[1]: The premix used is "Rabbit CMV at 1%" manufactured by NUTRISTAR INTERNATIONAL
[2]: SAA (sulphur amino-acids) and lysine levels calculated according to INRA (1989)

Health and growth performance

The average mortality rate during the whole experiment was 15.6%: 3, 2 and 3 rabbits died in the SB10, VF30 and BG30 groups respectively. Mortality, due to diarrhoea, occurred during the first and second experimental weeks can be probably related both to the stress of weaning (transport and new housing conditions) and the above mentioned deficiency in fibre as pointed out by Lebas *et al*. (1998) and Gidenne (2000). Diet composition induced significant difference in average daily growth and feed intake, but not in feed conversion ratio (Table 2).

Table 2: Growth rate and feed intake during the fattening period

Growth traits	Treatments (Diet)			Residual coef. variation (%)	Treatment significance
	SM10	FB30	BG30		
Rabbits/treatment	14	15	14	-	-
Initial weight (g)	564	565	565	20.0	ns
Final weight (g)	2111[a]	2065[a]	1877[b]	10.8	P<0.01
Average daily gain (g/d)	32.05[a]	31.06[a]	27.08[b]	13.7	P<0.01
Food intake (g/d)	99.2[a]	97.1[a]	88.9[b]	12.5	P<0.04
Feed conversion ratio	3.10	3.13	3.36	13.4	ns

a,b: on the same raw, means with different letters differ at P=0.05

The average daily growth was similar in the field beans and soya meal groups, but it was significantly (P<0.01) reduced (- 4.5 point on average) in the brewer's grains group, which was close (27.8 vs. 28 g/d) to the results obtained with rabbits of local population, fed the same experimental diets

(Berchiche *et al*., 1999). The possible differences in growth performances of BG30 group could be attributed to the lower feed intake (-9% on average), probably due to deficient of sulphur amino acids content, which was lower on BG30 diet than SM10 and FB30 diets (0.47 vs. 0.52 to 0.61% respectively), and near to the minimal recommendations of SAA content (0.47%) for growing rabbits (Berchiche *et al*., 1995). A palatability problems can be also evoked, like it was mentioned by Meartens and Salifou (1997). The consumption of field beans and soya meal groups were similar and significantly (P<0.04) higher than the consumption of brewer's grains group, but the difference don't excess 10%. However, experimental treatments had not effect on feed efficiency which was similar for the 3 diets: feed conversion ration varying from 3.10 to 3.36.

Slaughter performances

As mentioned above, head of rabbits was not skinned. The incidence of this not standard presentation is about 0.7-0.9 point, *i.e*. less than 1 point on the slaughter rate or on the total skin proportion, according to results published by Rochambeau *et al.* (1996). Thus, for comparison between our results and those of literature, slaughter rates obtained in the present study should be reduced by 1 point and skin relative weight increased by 1 point. The field beans diet did not affect the slaughter weight or the characteristics of the carcass which were similar to those of soya beans group. On the contrary, brewer's grain diet induced a significant (P<0.03) decrease (-10% on average) of the slaughter weight, with a tendency (P=0.08) to increase (+1.2 points) the proportion of the full digestive tract (in % of SW). Nerveless, the slaughter rate of cold carcass was similar for the 3 groups of rabbits. Proportions of liver and abdominal fat were not affected by the source of protein (Table 3).

Table 3: Slaughter performances of the three groups of rabbits

Slaughter traits	Treatments (Diet)			Residual coef. variation (%)	Treatment significance
	SM10	FB30	BG30		
Rabbits/treatment	8	8	8	-	-
Slaughter weight (SW) (g)	2130a	2031a	1941b	6.6	0.03
Hot carcass g (HC) (g)	1489	1438	1364	7.0	0.06
Cold carcass (CC) (g)	1423	1387	1308	7.3	0.08
Dressing percentage (HC/SW %)	69.9	70.7	70.2	2.1	ns
Dressing percentage (CC/SW %)	66.8	68.2	67.4	2.2	ns
Skin (% SW)	9.7	9.6	9.0	6.3	ns
Digestive tract (% SW)	17.0	16.7	18.1	8.1	0.08
Abdominal fat (% CC)	1.67	1.48	1.38	22.8	ns
Fresh Muscle (g)	140.9	136.4	131.3		
Fresh bone (g)	21.93	22.02	21.72		
Muscle/Bone ratio	6.49	6.21	6.10	9.6	ns

a,b: on the same raw, means with different letters differ at P=0.05

The slaughter weight of 1.9-2.1 kg was obtained later (84 days of age vs. 70-77 days) than that commonly practised in Europe (Ouhayoun, 1989; Dalle Zotte, 2002). Such a practice is justified by the constraints of the local market, which seeks weights of carcasses as high as possible (Berchiche *et al.*, 1996a and b, 1999 and 2000; Lakabi *et al.*, 2004). Nerveless, the slaughter weight of the rabbits allows the production of carcasses of 1.30 to 1.42 kg, which are heavier than those (0.95 to 1.0 kg) obtained at 8 weeks of age or earlier, with selected European commercial lines. (Rochambeau *et al*., 1996). The average slaughter rate, calculated after removing the legs extremities (-2.99% on average) and after correction for head skinning (+1% on average) as proposed above, corresponds to a dressing percentage of about 63.5%. This is fare higher than the 55-58% observed by Lebas *et al.* (2001), for European selected lines slaughtered between the ages of 10 and 14 weeks, for the same standard carcass presentation. This high slaughtered rate is one of the consequences of the low proportion of the raw skin (about 10.4% after head skinning correction) to be compared to the 14.5 to 16.0% mentioned by Rochambeau *et al.* (1996), which may be correlated with an adaptation to the relatively hot climate encountered in Algeria, as proposed by Lebas and Ouhayoun (1987). The carcasses of the 3 groups of rabbits were without any excess on fat, and the abdominal fat was only 1.5% on the CCW on average. Moreover, the muscle to bone ratio of the hind leg was similar than that observed with selected rabbits

slaughtered at 55% of adult weight (2.4 kg): 6.1 to 6.5 vs. 6.4 (Ouhayoun, 1989).

CONCLUSIONS

The utilization of the diet based at 30% of field bean, supplied with *dl* methionine, permits to obtain the same growth and slaughter performances than those obtained by soya meal diet. The brewer's grains can also be utilised with benefit at high level (up to 30% in this experiment) in the constitution of rabbit's feeds. The low cost of this feeding source makes the brewer's grains of interest to reduce the feeding cost of rabbits. However, the consumption of diet seems to deteriorate lightly the growth performances of rabbits (probably due to a deficit of amino acids), but not the slaughter rate. In conclusion, the field bean and the brewer's grains would constitute interesting and alternative sources of proteins, for rabbit feeding, in Algerian conditions of production. However, before recommendation for utilisation of field beans or brewer's grains in growing rabbit diets, at a level equal or higher than 30%, new experiments were necessary to study their consequences on growth performances (and on health) in well balanced diets.

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