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UTILISATION OF 3 DIETS BASED ON DIFFERENT PROTEIN SOURCES BY ALGERIAN LOCAL GROWING RABBITS

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SUMMARY - Three isonitrogenous (crude protein: 18.5% DM) and isofibrous (crude fibre: 10.5% DM) balanced diets were formulated and manufactured in Algeria with soya meal, field beans or brewer's grains as main protein source, in complement to dehydrated alfalfa and wheat bran. Diets were distributed *ad libitum* to 3 x 21 Algerian local rabbits from 5 weeks (weaning) until 13 weeks of age (slaughter). All rabbits were caged individually. Digestibility was determined with 7 rabbits per diet according to the standardised European method for dry matter, energy (67.2 - 70.9 - 67.7% for the 3 diets in the above order; P<0.01), nitrogen (77.3% on average) and crude fibre (22.6% on average). The protein source had no significant effect on growth rate (26 to 28 g/day) or on feed conversion ratio (3.9 g/g on average). Likewise, slaughter performances were similar for the 3 diets : mean slaughter yield was 64.2% and mean carcass weight was 1234 g (commercial presentation without legs extremities). It was concluded that rabbits of the local population are able to provide acceptable carcasses (1.2 kg - 2% kidney fat on average) if feeding with balanced pelleted feeds is prolonged until 13 weeks of age. The other conclusion was that field beans and especially brewer's grains are suitable ingredients for local production of balanced feeds.

Key words : Fattening rabbits - Algerian local rabbits - Field beans - Brewer's grains - Slaughter performances.

RESUME *- "Utilisation de 3 sources de protéines par des lapins en croissance de population locale algérienne". Trois aliments équilibrés isoprotéiques (Protéines brute : 18,5% MS) et isocellulosiques (cellulose brute : 10,5%), ont été formulés et fabriqués en Algérie. Leur source principale de protéines étaient respectivement le tourteau de soja, la féverole et la drêche de brasserie, en complément de luzerne déshydratée et de son de blé. Les aliments ont été distribué à volonté à 3 x 21 lapins locaux algériens du sevrage (5 semaines) à l'abattage (13 semaines). Les lapins étaient logés en cages individuelles. La digestibilité a été déterminée selon la méthode standardisée européenne avec 7 lapins par aliments, pour la matière sèche, l'énergie (67,2 - 70,9 - 67,7% pour les 3 aliments dans l'ordre ci-dessus; P<0,01), l'azote (77,3% en moyenne) et la cellulose brute (22,6% en moyenne). La source de protéine principale n'a eu aucun effet significatif sur la vitesse de croissance (26 à 28 g/jour) ou l'indice de consommation (3,9 en moyenne). De même, elle n'a eu aucun effet significatif sur les performance à l'abattage : rendement de 64,2% en moyenne et poids de carcasse de 1234 g (carcasse commerciale sans manchons). Les auteurs ont conclu que les lapins de la population locale étudiée sont susceptibles de fournir des carcasses acceptables pour le marché algérien (1.2 kg - 2% de gras perirénal), à condition d'être nourris avec un aliment granulé équilibré jusqu'à l'âge de 13 semaines. Par ailleurs la féverole et surtout la drêche de brasserie sont des matières premières parfaitement utilisables pour la production locale d'aliments complets équilibrés.*

Mots clés *: Lapins en engraissement - Lapins locaux algériens - Féverole - Drêche de brasserie - Performances à l'abattage.*

INTRODUCTION

Rabbit meat production is at present of interest in different Algerian rural areas. Such production is generally performed by farmers in small traditional units. Practice of more rational (modern) breeding methods is increasing , but some difficulties act as a brake on it's development (BERCHICHE et LEBAS, 1994; BERCHICHE *et al.*, 1996a). Some of the main reasons of this situation are :

- the unavailability of balanced pelleted feeds, and of high quality breeding stock
- the too low knowledge about production possibilities of the rabbit populations present in the farms and on the nutritive value of feeding materials effectively available.

The aim of the present work was the improvement of the knowledge about the local rabbit population, and about possibilities of utilisation of the local raw materials in balanced pelleted diets manufactured locally in Algeria.

MATERIALS AND METHODS

The experimental diets

Three diets were formulated and manufactured in Algeria (National Company ONAB), in direct relation with raw materials availability in the country. The objective was to make three iso-nitrogenous and iso-fibrous (iso-crude fibre) diets for growing rabbits, balanced according to INRA (1989) recommendations. The first diet was based on soya meal (**Soya diet**), the second on field bean grains (**Field bean diet**) and the third one was based on dehydrated brewer's grains (**Brewer's grains diet**) as main source of protein. The diets were described in table 1.

Animals and experimental design

The experiment was performed in Tizi-Ouzou University experimental facilities during the months of March and April. A total of 63 young rabbits were obtained at weaning (35 days) from a local farmer of the Tizi-Ouzou area. Parents of these rabbits have never been selected and young studied can be considered as a sample of the local population. Young rabbits were distributed in 3 groups of 21 according to individual live weight and litter origin. They were placed in individual all wire mesh cages organised in one level, and fed *ad libitum* one of the 3 experimental diets for 8 weeks. Live weight and feed intake were measured every week.
From each group, 7 rabbits were placed in digestibility cages in order to measure nutrients digestibility according to the European standardised method (PEREZ *et al,* 1995).
At the end of the experimental period, rabbits were slaughtered in order to measure skin, full digestive tract and carcass weights, according to BLASCO *et al.(*1993). The commercial carcass does not include legs extremities, but includes the head, liver, kidneys, and thoracic offal.

Table 1 : Composition of experirmental diets

DIETS	Soya	Field Bean	Brewer's Grains
Ingredients (%)			
• Soya meal	**10**	0	0
• Field bean	0	**30**	0
• Brewer's Grains	0	0	**30**
• Maize	20	0	0
• Barley	0	13	15
• Wheat bran	36	29	25
• Deshydrated Alfalfa	30	25	25
• Minerals and Vitamins	4	2.84	5
• dl-Methionine	0	0.16	0
Chemical composition			
• Dry matter (% as fed)	91.9	91.4	92.0
• Organic matter (% DM)	89.8	91.2	90.8
• Crude Protein (% DM)	18.2	19.1	18.0
• Crude Fiber (% DM)	10.0	10.2	11.5
• Ash (% DM)	10.2	8.8	9.2
• Crude Energy (kcal / kg DM)	4318	4349	4399

Chemical and Statistical analysis

All analysis were made at the *Station de Recherches Cunicoles* (INRA Research Centre, Castanet Tolosan , France). The chemical analysis necessary for digestibility calculations were made according the the AOAC recommendations. It must be emphasised that nitrogen determination was made with the physical "Dumas Method" (LECO apparatus).

Statistical analysis was made with the SAS-STAT package (SAS, 1987). The variance analysis was performed with the experiental group as single fixed effect.

RESULTS and DISCUSSION

Diets nutritive value

The protein content of the 3 diet was within the values recommended for growing rabbits (LEBAS 1992). Diets were not strictly iso-nitrogenous (table 1) , but the differences can be considered as acceptable for industrially manufactured feeds without previous analysis of the batches of raw materials effectively employed. The fibre level was also similar for the 3 diets , but the values were on average lower than those recommended for growing rabbit : 9.7% (as fed) *vs* 12 to 14% recommended (INRA 1989). This unexpected low fibre content may be related to a too low level of fibre in the employed batch of dehydrated alfalfa.

In relation with the low fibre level of the 3 diets, digestible energy contents (table 2) was on average higher than the recommended values : 2740 kcal / kg as fed *vs* 2500 to 2600 kcal. In addition the digestible energy (DE) and digestible protein (DP) content of the Field Bean diet was significantly higher than that of the Soya diet (+ 5.7% and + 8.6% respectively). Digestibility coefficients of crude fibre and of protein were not related with the main source of protein.

Table 2 : Digestibility of the 3 experimental diets (7 rabbits / diet)

DIETS	Soya	Field Bean	Brewer's Grains	Résidual C.V. (%)	Statistical significance
Digestibility coefficient (%)					
• Dry matter	**68.0**^{b}	**71.6**^{a}	**67.9**^{b}	3.7	★
• Crude Protein	**75.8**	**78.5**	**77.5**	5.8	ns
• Crude Fiber	**22.2**	**20.5**	**25.0**	13.8	ns
• Energy	**67.2**^{b}	**70.9**^{a}	**67.7**^{b}	3.7	★★
Nutrients content (/DM)					
• Digestible Energy (kcal/kg)	**2901**^{b}	**3085**^{a}	**2977**^{ab}	3.7	★
• Digestible Protein (%)	**13.8**^{b}	**15.0**^{a}	**13.9**^{b}	5.9	★
• Ratio DP / DE (g / 1000 kcal)	**47.5**	**48.6**	**46.8**	3.3	ns

★ P <0.05 ; ★★ P < 0.01 ; ns : Non Significant

Despite the high DE content of the diets, the DP to DE ratios (47 to 49 g DP / 1000 kcal DE) were within the recommended values (LEBAS 1992) as a consequence of a relatively high digestibility of the proteic fraction of the 3 diets (75.8 to 78.5 %).

Growth performances

During the whole trial, 3 to 5 rabbits died in the different experimental groups. As this mortality was observed mainly during the first week of the experiment (8/12 dead rabbits), it can be related more to the stress of transport and of the new housing conditions, than to any diet's characteristics.

The above mentioned small differences in diet's composition were not sufficient to induce any significant difference in daily growth rate, feed intake or feed conversion ratio (table 3). In this trial, the average daily growth rate from 5 to 13 weeks of age was higher than that of rabbits of the same origin studied in the same conditions in previous experiences (BERCHICHE *et al.*, 1996b) : 26-28 g / day in the present experiment *vs* 14 to 21 g / day in the previous ones.

Until the contrary would be proved, it can be assumed than this value of 26-28 g / day, reaches the growth potential of rabbits of this non selected population, the adult weight of which being only 3 kg. Effectively the daily growth rate represents 9 g per day for 1 kg of adult weight, which is very closed to the values observed for pure bred New Zealand White rabbits for example.

Table 3 : Growth rate and feed intake.

	Experimental groups (Diets)			Residual C.V. (%)	Statistical significance
	Soya	**Field Bean**	**Brewer's Grains**		
N° rabbits controlled	***16***	***18***	***16***	-	-
• Initial Weight (g)	**408**	**405**	**404**	27.1	ns
• Final Weight (g)	**1906**	**1951**	**1847**	11.8	ns
• Daily gain (g/d)	**27.2**	**28.1**	**26.2**	14.4	ns
• Feed intake (g/d)	**104.0**	**104.5**	**109.8**	16.1	ns
• Feed conversion ratio (FCR)	**3.86**	**3.72**	**4.10**	17.7	ns

ns : non significant (P > 0.20)

Slaughter performances

None of the parameters controlled at slaughter were significantly affected by the type of diet consumed during the fattening period (table 4). On average, the slaughter weight (1926 g) represented 64.2% of the adult weight. This level of relative maturity was widely higher than the optimum recommended by OUHAYOUN (1990), i.e. 55% of adult weight on basis of muscle/bone ratio and of adiposity. For the local Algerian rabbits, the recommended proportion of adult weight (55% of 3 kg = 1.65 kg) was observed in this experiment between 11 weeks (1.552 kg on average) and 12 weeks (1.730 kg). But because local market required heavier rabbits, growth was prolonged until 13 weeks of age.

Nevertheless, the abdominal fat of rabbits in the present experiment, was only 2 % of the carcass weight on average, i.e. without any excess of fat on the carcasses. Moreover, the muscle to bone ratio of the hind leg was higher than that observed with selected rabbits slaughtered at 55% of adult weight (2.4 kg) : 9.0 to 9.5 in this experiment *vs* 6.2 to 6.3 (PERRIER, 1998).

Thanks to a high slaughter yield, the average carcass weight was 1234 g (commercial carcass without legs extremities). This value can be considered acceptable for rabbits sold on local Algerian market, even if sometimes heavier carcasses are in demand.

Table 4: Slaughter performances of the rabbits .

Experimental Groups	**Soya**	**Field Beans**	**Brewer's Grains**	Residual C.V. (%)	Staistical significance
Number of rabbits controlled	***16***	***19***	***16***	-	-
• Slaughter Live Weight (g)	**1933**	**1949**	**1893**	9.5	ns
• Skin (g)	**196**	**204**	**196**	14.7	ns
• Full Digestive Tract (g)	**333**	**359**	**344**	13.9	ns
• Commercial Carcass (g)	**1249**	**1241**	**1210**	10.2	ns
• Slaughter yield (%)	**64.7**	**63.7**	**63.9**	3.1	ns
• Liver (g)	**93.4**	**89.5**	**91.5**	18.8	ns
• Perirenal fat (% carcass)	**1.95**	**2.37**	**2.07**	30.4	ns
One Hind leg *(number controlled)*	***10***	***10***	***10***	-	-
• Weight (g)	**133**	**130**	**128**	6.5	ns
• Muscle / Bone ratio	**9.45**	**9.48**	**9.00**	10.0	ns

ns : non significant.

CONCLUSION

This experiment proved that rabbits of Algerian local population are able to produced carcasses acceptable for the local market on condition that growth is prolonged until 13 weeks of age and that a well balanced pelleted diet is provided.

The 3 studied proteins sources were suitable for the constitution of balanced diets, in complement of alfalfa and wheat bran. The result was classical for soya meal, employed in this experiment as control. The possibility of utilisation of field bean was proved in different previous experiments performed with selected rabbits (BERCHICHE *et al.*, 1995). Nevertheless, the high digestibility of the field bean diet must be emphasised. As it was suggested by LEBAS *et al.* (1996) and by MAERTENS and SALIFOU (1997) brewer's grains can also be utilised with benefit at high level 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.

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