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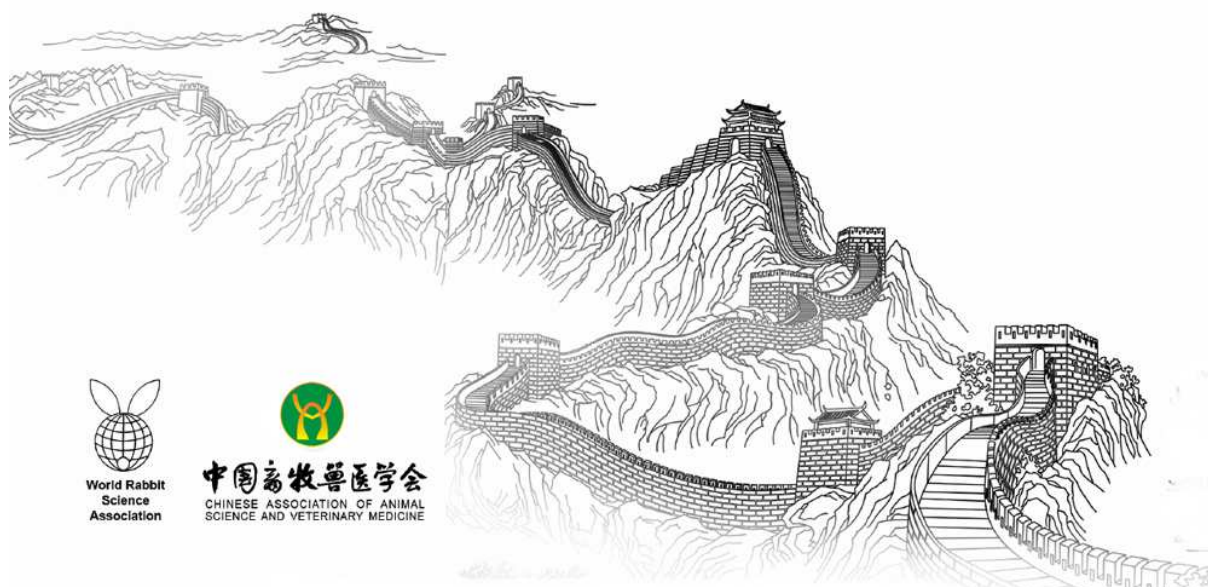
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FEEDING *QUERCUS ILEX* ACORNS TO FATTENING RABBITS: EFFECTS ON GROWTH AND CARCASS CHARACTERISTICS

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ABSTRACT

The effect of the inclusion of holm oak acorns (*Quercus ilex*) in a pelleted complete diet was measured on growth performances and carcass characteristics of rabbits from an Algerian population. Animals were weaned at 35 d old (mean weight: 713g), allotted in two groups (30 per diet) and individually caged. Each group was fed ad libitum during six weeks, either the control diet or the experimental diet containing 20% of holm oak acorns (g/kg as fed: 760 DM, 224 NDF, 146 ADF, 85 ADL and 48 CP) in total replacement of barley grains. Weight gain was slightly lower in acorn diet (35.9 vs 33.7 g/d, $P=0.04$) for the whole fattening period (35-77d), while feed intake and feed conversion were similar for the two diets. Health status and slaughter traits were not affected by the holm oak acorns incorporation. Holm oak (*Quercus ilex*) acorn could replace barley grain like source of energy in rabbit diet without effect on their health.

Key words: Holm oak acorns, Barley, Rabbits, Growth, slaughter traits.

INTRODUCTION

Quercus ilex (Holm oak) formerly known as *Quercus rotundifolia* and *Quercus ballota* is the dominant species in both Mediterranean forests. They are, with oak cork (*Quercus suber*), the most abundant species of genus *Quercus* in Algeria. In several countries, holm oak acorns are consumed by human population as in Algeria, in Italy or in Spain. Also, those acorns are a major component in the feeding systems of many Mediterranean wild and livestock species (Galván et al., 2011). Many studies are reported on the use of holm oak acorns mostly in pig diets, less in ruminants and rarely in broilers. For rabbits, except the study of Zamora-Lozano et al. (1985) on the intake of acorns by rabbits in continuous grazing pastures, there is no work on the use of holm oak acorns in pelleted diet for rabbit. However, acorns of others *Quercus* species were tested with success for rabbits such as *Quercus coccifera* (Nowar et al., 1994) or *Quercus suber* (Gasmi-Boubaker et al., 2007).

Thus, the aim of this experiment was to study the effect of the inclusion of holm oak acorns (*Quercus ilex*) in the diet on fattening rabbit performances and carcass characteristics.

MATERIALS AND METHODS

Diets

The whole holm-oak (*Quercus ilex*) acorns were harvested manually in January in *Quercus* forest in Tizi-Ouzou area, partially grinded and sun dried. Samples of dried holm oak were collected in the feed mill factory after grinding (sieves with a diameter of 3 mm) in order to determine its chemical composition (Table 1). A control diet was formulated to fit with nutritional requirement of the growing rabbit according to the recommendations of De Blas and Mateos (2010). An experimental diet containing the same ingredients with the same proportion as in control diet but with total replacement

of barley by whole holm oak acorn (Table 1) is prepared. Both control and experimental diets were pelleted (4 mm diameter, 9 mm length).

Animals and experimental design

Rabbits were weaned at 35 d old (mean weight: 713g), allotted in two groups (30 per diet), according to weaning weight and litter origin. They were placed in wire mesh individual cages in flat deck disposition till 77 d old. During the 6 weeks of the experiment, rabbits were fed ad libitum one of the two diets, with a weekly control of live weight, feed intake and a daily control of mortality according to Fernandez-Carmona et al. (2005). Fresh water was always available.

At the end of the experiment, all rabbits (24 per group) were slaughtered (without fasting) at 10 a.m. in controlled conditions, according to Blasco and Ouhayoun (1996), and the weight of skin, full digestive tract, cold carcass, liver and perirenal fat were recorded.

Chemical Analyses

The following analyses were performed at INRA of Toulouse (UMR 1388 GenPhySE, France) on feeds and *Q. ilex* acorn according to EGRAN harmonised procedures (EGRAN, 2001): humidity, crude ash, crude protein (N x 6.25, Dumas method, Leco apparatus), energy (adiabatic calorimeter Parr), and fibres (NDF, ADF and ADL) according to the sequential procedure of Van Soest.

Statistical Analysis

analysis of variance was used to evaluate the effects of the diet on growth performances and slaughter traits of rabbits. Significant differences among the treatments means were determined using Duncan's test.

RESULTS AND DISCUSSION

Holm oak corns composition and experimental feeds

According to their chemical composition (Table 1), holm oak acorns can be considered as height energetic feedstuff. As reported by Rodríguez-Estévez et al. (2008), kernel of this fruit has a very high level of carbohydrates (80% of DM) and lipids (5-10% of DM) with oleic acid content up to 60%.

Table 1. Ingredient and chemical composition of experimental diets and of *Q.ilex* Acorn¹

Ingredient, % as fed	Control diet	Acorn diet	<i>Q.ilex</i> acorns
Barley	20.00	-	
<i>Q.ilex</i> Acorn	-	20.00	
Soybean meal	13.00	13.00	
Dehydrated Alfalfa	35.00	35.00	
Wheat bran	30.50	30.50	
Sodium chloride	0.50	0.50	
Vitamin/mineral premix	1.00	1.00	
Chemical composition, g/kg, raw basis			
Dry matter	968	872	760
Crude ash	70	69	20
Crude protein (Nx6.25)	168	163	48
NDF	314	364	224
ADF	146	170	146
ADL	33	51	85
Gross energy, MJ/kg	16.58	17.02	17.91

¹: analytical value of a sample from the material incorporated in the Acorn diet

Reversely, those acorns contained a moderate amount of crude protein (47g/kg as fed). Galvána et al. (2011 and 2012) find that protein content in holm acorns varied among populations from 29 to 59

g/Kg as fed. Those amounts are near to those reported for *Coccifera* (59 g/kg; Nowar et al, 1994) or *Q. suber* (56 g/Kg; Gasmi-Boubaker et al., 2007).

The acorns presented a relatively high level of fibre (146 g/kg ADF and 85 g/kg ADL) due to shell composition that has a high level of tannins and lignin (Rodríguez-Estévez et al., 2008).

Growth performances

Although weight gain was slightly lower in acorn diet (35.9 vs 33.7 g/d, $P=0.04$) over the whole fattening period 35-77d (Table 2), the daily intake did not differ among the 2 groups and the feed conversion tended to be lower for Acorn group ($P=0.06$). These performances reached a relatively high level, taking into account the genetic potential of local rabbit line. They were close to those obtained with rabbits of same population by Kadi et al. (2011).

Table 2: Effect of inclusion of *Q.ilex* Acorn on feed intake and growth of rabbits.

	Control diet	Acorn diet	SEM	P
Rabbits, no. ¹	24		24	
Period 35-56 j				
Live weight at 35 d, g (weaning)	713	714	62.5	0.992
Live weight at 56 d, g	1401	1521	75.6	0.314
Weight gain, g/d	38.2	35.4	1.3	0.216
Daily intake, g/d	94.0	101.1	5.6	0.425
Feed conversion, g/g	2.70	2.75	0.1	0.816
Period 56-77 j				
Live weight at 77 d, g (slaughter)	2121	2173	79.1	0.646
Weight gain, g/d	35.9	33.6	0.7	0.041
Daily intake, g/d	129.9	131.2	3.7	0.819
Feed conversion, g/g	3.56	3.90	0.1	0.067
Period 35-77 j				
Weight gain, g/d	35.9	33.7	0.7	0.033
Daily intake, g/d	115.1	118.5	4.6	0.624
Feed conversion, g/g	3.21	3.32	0.1	0.518

¹: number of rabbits at the end of experimental period.

Slaughter performances

The incorporation of holm oak acorns did not impair the slaughter traits, all parameters measured did not differ among the 2 groups (Table 3). The dressing out percentage (65%) was close to that reported by Kadi et al. (2004), higher than that reported by Kadi et al. (2011) and lower than obtained by Berchiche et al. (2000) with the same rabbit population.

Unlike to what suspected view the wealth holm oak acorns fat, perirenal fat known to be a good indicator of adiposity of the carcass was not high and did not differ among the 2 groups.

Table 3. Effect of inclusion of *Q.ilex* Acorn on slaughter traits of rabbits¹

	Control diet	Acorn diet	SEM ²	P
Body weight (BW), g	2121	2173	82	0.646
Skin weight, g	213	226	11.7	0.443
Full digestive tract, % BW	17.0	16.4	0.5	0.800
Cold carcass weight, g	1311	1345	54	0.691
Liver weight, g	106	98	5.5	0.597
Perirenal fat, % BW	0.91	1.02	0.08	0.317
Dressing out percentage, %	65.3	66.0	0.6	0.250

¹ Slaughter at 11 weeks of age. ² n = 22 per treatment. SEM: standard error of the mean.

CONCLUSIONS

Holm oak (*Quercus ilex*) acorn could replace barley grain like source of energy in rabbit diet, without apparent effect on their health. The results obtained in this study motivate further investigations on

those acorns to precise with a larger number of animals the impact on digestive health, and to precise its nutritive value for the growing rabbit.

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REFERENCES

- Berchiche M., Kadi S. A., Lebas F. 2000. Valorisation of wheat by-products by growing rabbits of local Algerian population. *In Proc.: 7th World Rabbit Congress, 2000 July, Valencia, Spain. Vol. C: 119-124.*
- Blasco A., Ouhayoun J. 1996. Harmonization of criteria and Terminology in rabbit meat research. Revised proposal. *World Rabbit Sci.*, 4, 93-99.
- EGRAN 2001. Technical note: Attempts to harmonise chemical analyses of feeds and faeces, for rabbit feed evaluation. *World Rabbit Sci.*, 9: 57-64.
- Fernandez-Carmona J., Blas E., Pascual J.J., Maertens L., Gidenne T., Xiccato G., Garcia J. 2005. Recommendations and guidelines for applied nutrition experiments in rabbits. *World Rabbit Sci.*, 13: 209-228.
- Galván J.V., Valledor L., Ma R., Cerrillo N., Pelegrín E.G., Jorrín-Novoa J.V. 2011. Studies of variability in Holm oak (*Quercus ilex* subsp. *Ballota* [Desf.] Samp.) through acorn protein profile analysis. *J. Proteomics* 74: 1244-1255
- Gasmi-Boubaker A., Abduli H., Lozada M. M., Tayachi L., Mansouri M., Zaidid I. 2007. Cork oak (*Quercus suber* L.) acorn as a substitute for barley in the diet of rabbits; Effect on *In vivo* digestibility, growth and carcass characteristics. *J. anim. Vet. Adv.*, 6: 1219-1222.
- De Blas J.C., Mateos G.G., 1998. Feed Formulation. *In: De Blas C., Wiseman J. (Eds). The Nutrition of the Rabbit. CABI Publishing. CAB International, Wallingford Oxon, UK, 241-253.*
- Gea-Izquierdo G., Cañellas I., Montero G. 2006. Acorn production in Spanish holm oak woodlands. *Invest Agrar: Sist Recur For* 15: 339-354
- Kadi S. A., Belaidi-Gater N., Chebat F. 2004. Inclusion of crude olive cake in growing rabbits diet: Effect on growth and slaughter yield. *In Proc.: 8th World Rabbit Congress, 2004 September, Puebla, Mexico. Vol. 2: 1202-1207.*
- Kadi S. A., Guermah H., Bannelier C., Berchiche M., Gidenne T. 2011. Nutritive value of sun-dried *Sulla* (*Hedysarum flexuosum*) and its effect on performance and carcass characteristics of growing rabbits. *World Rabbit Sci.*, 19, 151-159.
- Nowar M. S., Al-Shawabkeh K., Nissour H. 1994. Evaluation of oak acorn (*Quercus coccifera*) as untraditional energy feedstuff for complete substitution of corn grains in fattening rabbit ration. *Cah. Opt. Méd.*, 8, 177-182.
- Rodríguez-Estévez V., García Martínez A., Mata Moreno C., Perea Muñoz J.M., Gómez Castro A.G. 2008. Measures and nutritional characteristics of *Quercus* acorns from the dehesa. *Arch. Zootec.*, 57, 1-12.
- Zamora Lozano M., Sanchez Rodriguez M., Gallego Barrera J., Mata Moreno C., Peinado Lucena E. 1985. Intake of acorn by rabbits kept under continuous grazing. *Arch. Zootec.*, 34, 257-265.

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Aim of the work

The aim of this experiment was to study the effect of the inclusion of holm oak acorns (*Quercus ilex*) in the diet on fattening rabbit performances and carcass characteristics.

Material and Methods

- ✓ Whole holm-oak (*Quercus ilex*) acorns were harvested manually in January in *Quercus* forest in Tizi-Ouzou area (Algeria), partially grinded and sun dried.
- ✓ A control diet was formulated to fit with nutritional requirement of the growing rabbit.
- ✓ An experimental diet containing the same ingredients with the same proportion as in control diet but with **total replacement of barley by whole holm oak acorn**.
- ✓ 70 rabbits of Algerian white local population, weaned at 35 d old (mean weight: 713g), allotted in two groups (30 per diet) and individually caged were fed ad libitum either the control diet or the experimental diet during six weeks.
- ✓ At the end of the experiment, all rabbits were slaughtered in controlled conditions, according to Blasco and Ouhayoun (1996)



Results

Ingredient and chemical composition of experimental diets and of *Q.ilex* Acorn¹

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- ✓ The results obtained in this study motivate further investigations on those acorns to precise with a larger number of animals the impact on digestive health, and to precise its nutritive value for the growing rabbit.

