EFFECT OF INCREASING LEVEL OF BREWER'S GRAIN IN DIET OF RABBITS ON GROWTH AND CARCASS TRAITS

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ABSTRACT

The effect on growth and carcass quality of increasing level of brewer's grain (0, 20 and 30%) in growing rabbit diet was studied. A total of 180 rabbits (5 weeks old, average live body weight of 860 ± 147g) were divided into three experimental groups of 60 rabbits and housed in collective cages (4 rabbits per cage) until slaughter (77 days). Each group was fed *ad libitum*, either the control diet (B0) or the experimental diet containing 20% (B20) or 30% (B30)of dried brewers grains (DBG). Health status was not affected by the treatment. Also, growth and ingestion performances did not differ significantly between the 3 groups (individual weight gain=29.2 – 30.5g /d and feed intake per cage = 379 - 390 g /d). Feed conversion was higher ($P<0.01$) in B20 group compared to the 2 other groups (3.92 *vs.* 3.65). The incorporation of DBG did not alter the carcass characteristics of the groups. Increasing level of brewer's grain until 30%, in partial substitution to soybean meal and decreasing alfalfa and barley grain rates can be used in rabbit diets without effect on health, growth performance or carcass traits.

Key word: Brewer's grain, Rabbits, Growth, Carcass traits.

INTRODUCTION

In Algeria, the main raw materials which compose industrial rabbit feed are imported, which makes the price of the feed expensive, thus constituting a burden and major constraint for the breeders. Indeed, feed represents about 60% of the production costs of rabbit meat (Gidenne *et al.*, 2017).The search for alternative sources of energy, proteins and fibres is the subject of several studies in our laboratory (Kadi, 2012; Guermah, 2016; Harouz-Cherifi, 2018; Djellal, 2018).

The brewer's grain is a residue of the beer industry, recovered at the end of the brewing process that barley seeds undergo during the production of beer. According to the Feedipedia database (Heuzé *et al*., 2017), it provides proteins (25.8%), fibres (NDF: 56.3%, ADF: 21.9%, ADL: 5.4%) and even energy (4942 kcal / kgDM), making it an important alternative source for both lactating dairy cows (Westendorf *et al*., 2014) and growing rabbits (Fernandez-Carmona *et al.*, 1996; Maertens and Salifou, 1997). Especially since rabbits are known for their ability to take advantage of proteins contained in plants and agro-industrial co-products rich in fibre (Gidenne, 2015). In addition, this agro-industrial co-product, available locally, can also be used as a partial substitute for fibre, protein and energy sources, thus reducing the usual and imported raw materials (alfalfa, soybean meal and barley) used in feeding of rabbits.

In this sense, our study aims to evaluate the effect of incorporating, at increasing rates, locally available brewer's grain into the growing rabbit feed, on growth and carcass traits.

MATERIAL AND METHODS

Diets

Fresh brewer's grain was obtained from a local brewery (Algiers). Because of its high water content, it was sun-dried by spreading over a thin layer on a plastic sheet. It was turned twice a day, during 5 days, to improve the drying process. A control diet (B0) was formulated to fit with nutritional requirement of the growing rabbit. Two experimental diets containing 20% (B20) and 30% (B30) of

dried brewer's grain (DBG) in partial replacement of soybean meal with decreasing alfalfa and barley rates (Table 1) were prepared. The control and experimental diets were pelleted (4 mm diameter, 9 mm length).

Animals and measurements

A total of 180 rabbits of Algerian white local population, weaned at 35 days(mean live weight = 860 ± 147g),were divided into three groups (n= 60 in each)and placed in collective wire mesh cages (4 rabbits /cage) in flat deck disposition. During the 6 weeks of the experiment, they were fed *ad libitum* with one of the experimental diets, with a weekly control of live weight, feed intake and a daily control of mortality and morbidity. Fresh drinking water was freely available. At the end of the experiment (77d), 10 rabbits/group were slaughtered, without fasting, in controlled conditions. The weight of skin, full digestive tract, hot and cold carcass, liver, perirenal, inguinal and scapular fat were recorded according to Blasco and Ouhayoun (1996).

Chemical Analyses

The following analyses were performed at INRA (Occitanie Toulouse centre, UMR 1388 GenPhySE, France) on feeds and brewers grain according to European harmonized procedures (EGRAN, 2001): dry matter, crude ash, crude protein (N x 6.25, Dumas method, Leco), gross energy (Parr adiabatic calorimeter) and fibres fractions (NDF, ADF, ADL) according to the Van Soest sequential method.

Statistical Analysis

Data were subjected to ANOVA, using R software (V.2.15.02), to evaluate the effects of the diet on growth performance and slaughter parameters. Significant differences between treatments were determined using Duncan's test. Chi-square test was used to compare mortality and morbidity between the groups.

RESULTS AND DISCUSSION

Brewer's grains composition and experimental feeds

According to its composition (Table 1), brewer's grain is a suitably fibrous, energetic and protein feedstuff and a valuable by-product in diets for rabbits (Maertens and Salifou 1997; Guermah *et al.*, 2016, Harouz-Cherifi *et al.*, 2018a,b).

Table 1: Ingredients and chemical composition of diets and of brewer's grain

Ingredients (%)	**B0**	**B20**	**B30**	**Brewer's grain**
Brewer's grain	-	20	30	
Wheat bran	31	31	31	
Barley	20	15	12.5	
Soybean meal	12	6	3	
Local dried alfalfa	35	26	21.5	
Minerals	1	1	1	
Vitamin/premix	1	1	1	
Chemical composition, g/kg DM				
Dry matter, g/kg	867	870	869	901
Crude ash	105.4	122.0	105.4	54
Crude protein	155.0	142.0	145.7	204
NDF	280.0	327.0	344.6	602
ADF	147.0	149.0	159.6	213
ADL	34.0	36.0	38.9	43
Gross energy, MJ/kg	15.8	15.7	15.9	19.9

Growth performances

The health status evaluated by the health risk index (HRi=morbidity+mortality) was similar in the3groups. In total 25 rabbits died out of 180 animals (8, 9 and 8 rabbits in B0, B20 and B30 group respectively, no antibiotic treatment used during the trial). The mortality and morbidity occurred during the first and second weeks of fattening, which could be related to weaning stress. During the

whole fattening period, growth performance and feed intake were not affected by the level of DBG (Table 2), contrary to feed conversion ratios which were significantly different among the 3 groups. Daily weight gain obtained here (30g/d) was higher than obtained by Lounaouci-Ouyed *et al*. (2008, 27g/d), Hannachi-Rabia *et al.* (2016, 25.4g/d) and Mouhous *et al.* (2017, 25.7g/d) with rabbits of same population and same housing mode (4 rabbits /cage).

Table 2: Growth, feed intake and feed conversion ratio of rabbits in the dietary groups.

	Control diet B0	**B20**	**B30**	SEM	***P***
N[1]	52	51	52		
Period 35-56d					
Live weight at 35d	860	860	860	19	1.008
Live weight at 56d	1435	1424	1445	29	0.880
Weight gain, g/d	29.5	29.2	31.9	1.13	1.022
Feed intake per cage, g/d	324	335	337	10.2	0.630
Feed conversion ratio cage	2.98[a]	3.39[b]	3.42[b]	0.11	0.019
Period 56-77d					
Live weight individual at 77d	2064	2024	2107	33	0.224
Weight gain individual g/d	31.9	30.5	32.9	0.82	0.129
Feed intake per cage, g/d	430	423	431	18.1	0.945
Feed conversion ratio, cage	3.80[a]	4.33[b]	4.02[ab]	0.20	<0.01
Period 35-77d					
Weight gain individual, g/d	30.4	29.1	31.4	0.67	0.060
Feed intake per cage, g/d	378	379	389	2.53	0.783
Feed conversion ratio, cage	3.52[a]	3.92[b]	3.78[ab]	0.07	<0.01

[1]: number of rabbits at the end of experimental period
B0, B20, B30: see in Table 1.
[a,b]: Means with different superscripts are significantly different (P<0.05).

Slaughter traits

The incorporation of increasing level of DBG did not impair slaughter traits (Table 3). The dressing out percentage (59 – 60%) was similar to the values that reported by Kadi *et al.* (2011, 59%) but lower than that reported by Lounaouci-Ouyed *et al*. (2008, 67%) and Kadi e*t al.* (2016, 65%) with the same rabbit population. Therefore, the increase in the level of incorporation of DBG did not affect the carcass characteristics. The weights of skin, digestive tract, liver and perirenal fat seem acceptable and corroborate the recommendations of Ouhayoun (1989).

Table 3: Slaughter traits of rabbits in the dietary groups

	B0	**B20**	**B30**	SEM	***P***
N	10	10	10		
Body weight (BW), g	2164	2151	2166	37.9	0.952
Weight of skin , g	271	266	260	5.36	0.544
Weight of full digestive tract , g	388	428	420	14.5	0.148
Hot carcass weight , g	1319	1285	1303	23.9	0.620
Chilled carcass weight , g	1294	1265	1289	24.4	0.665
Liver weight , g	83	77	82	4.44	0.560
Kidneys weight , g	13	15	13	0.41	0.438
Perirenal fat , g	19	19	23.6	1.65	0.657
Inguinal fat , g	3	4	3.97	0.34	0.726
Scapular fat, g	5	5	4.83	0.41	0.400
Dressing out percentage of hot carcass , %	60.9	59.7	60.1	0.53	0.215
Dressing out percentage of chilled carcass , %	59.8	58.8	59.5	0.58	0.192

B0, B20, B30 see in Table 1.

CONCLUSION

Increasing incorporation level of brewer's grain (0, 20 and 30%), in partial substitution to soybean meal and decreasing alfalfa and barley grain rates, in diet of rabbits, resulted in same performances compared to control feed, without affecting health status, growth and slaughter traits. It is confirmed that brewer's grain can be considered as an alternative raw material in rabbits' diets.

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