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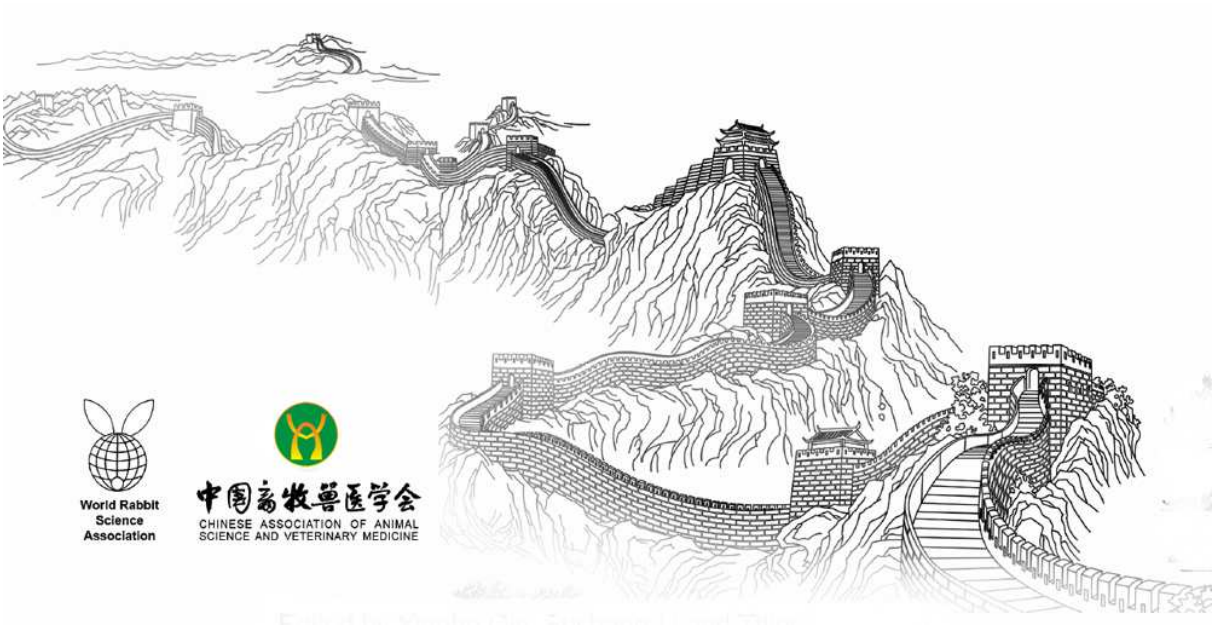

FEEDING VALUE OF BREWER'S GRAIN AND MAIZE SILAGE FOR RABBITS

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ABSTRACT

The role of fibres in the growing rabbit's nutrition is very important. Dehydrated alfalfa is the mainly used source of fibre in rabbit diets, but it is too expensive in many countries. Less expensive sources are more suitable, but the determination of their nutritive value is a fundamental step for their use in feed formulation. The aim of the present study is the determination of feeding value of sundried brewer's grain and maize silage (whole plant) for the fattening rabbit. Twenty-four, individually caged 8-week-old rabbits were used in this trial. Both wet products were sundried and grinded before they were incorporated in a basal diet. The inclusion level at the expense of all basal ingredients amounted to 30%. Basal diet and both experimental diets were fed *ad libitum* to 8 rabbits during the four days balance trial. The determined digestibility of protein, fat, crude fibre and NDF amounted to 76.2% and 77.2%; 86.5% and 99.1%; 8.1% and 8.3% and 28.0% and 13.5%, respectively for brewer's grain and maize silage. The digestible energy content amounted to 11.66 MJ/kg DM (brewer's grain) and 11.10 MJ/kg DM (maize silage). Both by-products have potential as alternative feedstuff in rabbit diets.

Key words: brewer's grain, maize silage, digestibility, rabbit.

INTRODUCTION

Raw materials that contain a certain amount of fibre fractions are suitable for rabbits as they need different sources of fibre in their diet. Brewer's grain is a wet by-product of the beer industry. According to Heuzé et al. (2015), they contain on dry matter (DM) basis 25.8% crude protein (CP), 22% acid detergent fibre (ADF) and 5.4% lignin (ADL) Data about the feeding value of dried brewer's grain for rabbits are scarcely reported (Maertens and Salifou, 1997).

Maize silage is a major forage and energy source around the world for dairy cows Feedipedia database (http://www.feedipedia.org/) classed maize silage in category of cereal and grass forage. Few studies are available on its nutritive value for the rabbit (Martinez et al., 2006).
The stage of maturity at harvest and mechanical processing are major factors in determining the nutritive value of silage. In order to formulate balanced diets, the knowledge of the feeding value is essential information (Maertens et al., 2002). Therefore, the objective was to determine the nutrient digestibility and energy content of sundried maize whole plant silage and brewer's grain, in fattening rabbit diets.

MATERIALS AND METHODS

Animals and experimental design

Rabbits taken from a large group of fatteners which were weaned at 35 days of age. At the age of 8 weeks 24 healthy rabbits were selected at random for the digestibility trial. They were allotted (8 per diet), according to their weight (mean weight: 2035 ± 139 g) to one of the 3 diets. They were used to determine the feeding value of brewer's grain and maize silage and they were housed in digestibility

cages. The balance trial was executed (duration: 4 days) after one week of adaptation to the experimental diets and to the cages. During the whole period, rabbits were fed *ad libitum* and the apparent digestibility was measured according to the European methodology (Perez et al., 1995).

A basal diet (Table 1) was formulated to fulfil the requirements of fattening rabbits (De Blas and Mateos, 2010). The experimental diets were obtained by replacing 30% of the basal diet by the test raw material (Brewer's grain or maize silage).

Table 1. Basal diet used for the digestibility trial.

Ingredient	%	Ingredient	%
Alfalfa meal 16	30.10	Vitamin and mineral premix	2.50
Wheat	9.50	Molasses	4.00
Wheat middlings	17.50	NaCl	0.13
Beet pulp	11.00	L-Lysine HCl	0.125
Sunflower meal 28	15.00	DL-methionine	0.120
Full fat soybeans	2.00	Clinacox	0.02
Flax chaff	7.00		
Soybean oil	1.00		

Chemical Analyses

Test raw materials, diets and faeces were analysed for their dry matter, ash, nitrogen, lipids, gross energy, crude fibre, NDF, ADF and ADL (AOAC 2000, procedures) and Van Soest *et al*. (1991). The chemical analyses were performed at ILVO laboratory according to EGRAN harmonised procedures

Statistical Analysis

Digestibility data of diets and performance data were submitted to a one way ANOVA (StatSoft 2012). Differences between means were tested by the least significant difference test. Data are presented as means and standard deviation.

RESULTS AND DISCUSSION

No cases of mortality or morbidity have been observed during the test. In Table 2, the chemical composition of the two test ingredients and the 3 experimental diets is presented. The tested brewer's grain contained 20.7% CP and 10.3% fat. However, the CP content was lower than the one reported by Heuzé et al. (2015). The ADF content of brewer's grain was 19.16%.
The maize silage on the other hand had a low fat (2.9%) and CP (5.7%) content in line with the value mentioned by Martinez et al. (2006) at the intermediate maturity stage (mi-dent) and with those in Feedipedia. However, the batch maize silage used had a very low crude fibre (13.2%) and lignin content (1.5%) compared with the values presented in Feedipedia (a mean crude fibre of 20.5% and 2.4% of lignin is supposed). This indicates very clearly that the maize silage tested was harvested at young stage.

Table 2. Analysed composition of the test ingredients and diets (% as fed).

	Brewer's grain	Maize silage	Basal diet	Diet 30% Brewer's grain	Diet 30% Maize silage
Dry matter	92.31	88.44	91.71	92.43	91.84
Crude fat,%	10.34	2.93	4.35	5.87	4.52
Crude protein,%	20.66	5.71	16.97	17.91	13.99
Neutral detergent fibre,%	49.14	26.02	29.98	35.48	30.16
Acid detergent fibre, %	19.16	14.44	17.42	17.11	17.09
Acid detergent lignin, %	4.28	1.53	4.05	3.68	3.48
Gross energy, (MJ/kg)	19.92	16.35	17.05	18.00	17.15

The digestibility coefficients (DCF) of the diets presented in Table 3 were not significantly different with the exception of the crude fat. This is partly due to the large variability in DCF for the maize silage.

Table 3. Digestibility (%) of the diets.

	Diets			
	Basal	30% Brewer's grain	30% Maize silage	P
Dry matter	59.0 ± 1.3*	55.4 ± 0.8	59.5 ± 3.6	0.152
Crude protein	74.5 ± 1.8	75.0 ± 1.5	75.3 ± 2.8	0.881
Crude fat	77.7^{a**} ± 1.6	80.4^{b} ± 1.4	84.0^{c} ± 0.9	0.000
Crude fibre	24.4 ± 2.9	19.5 ± 1.4	19.7 ± 9.1	0.612
Neutral detergent fibre	34.8 ± 2.2	32.7 ± 2.8	28.5 ± 7.2	0.372
Acid detergent fibre	22.6 ± 4.9	18.6 ± 2.2	19.5 ± 5.2	0.702
Gross energy	64.4 ± 1.3	61.3 ± 0.7	63.9± 3.6	0.356

*N=8/diet
**Means in the same row, sharing different superscripts differ significantly (P<0.05)

The DM digestibility of the maize silage diet is comparable (59%) to that reported by Martinez et al. (2006) who substituted 20 % or 40% of maize silage at early dough stage. The energy digestibility (63.9%) was higher than the values obtained by the same authors at early stage but in line with those found at mid-dent stage and full maturity stage (between 60 and 64%). The CP digestibility of the maize silage diet (75.3%) was higher than for all qualities tested by Martinez et al.(2006).
The DCF of brewer's grain and maize silage are presented in Table 4. A good protein digestibility for rabbits (76.2%) was observed for brewers' grain. It exceeds the values determined for barley in the EGRAN tables (Maertens et *al*., 2002). A high crude fat digestibility was determined for the quantitative (10.3%) important fat fraction with Brewer's grain which explained the high digestible energy content. The actual batch had a lower fibre digestibility (e.g. NDF: 28.0% *vs* 39.6%) but a higher energy content (11.66 MJ instead of 10.06 MJ/kg DM) than reported by Maertens and Salifou (1997).
The batch maize silage tested showed a good protein and fat digestibility (77.2% and 99.1%, respectively). The digestible protein of maize silage is low (4.4 %, DM) and in line with the values estimated by Martinez et al. (2006) for the maize silage mi-dent stage (between 4.5 and 4.7 depending of inclusion level and methodology).

Table 4. Digestibility (%) of brewer's grain and maize silage.

	Brewer's grain	Maize silage
Dry matter	47.3	60.6
Crude protein	76.2	77.2
Crude fat	86.5	99.1
Crude fibre	8.1	8.3
Neutral detergent fibre	28.0	13.5
Acid detergent fibre	9.3	12.2
Gross energy	54.1	62.8
Dig. energy (MJ/kg DM)	11.66	11.10
Dig. protein (% DM)	15.74	4.4

An energy value of 11.1 MJ/Kg DM was obtained. This is higher than the maximal values obtained by Martinez et al. (2006) at full maturity stage. That is: 10.4 MJ/kg DM, both with the substitution method and the regression method.

The energy value determined for maize silage (i.e., 11.10 MJ/kg DM or 9.82 MJ/kg for the sundried product) is quite comparable with beet or citrus pulp but much higher than other fibrous products and alfalfa meal (Maertens *et al.,* 2002).

CONCLUSIONS

Both tested products showed a good digestibility for rabbits and a quite high energy value. If the dried products are available, they can be considered as an alternative raw material in rabbit diets.

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