Use of dehydrated distillery grains with solubles in diets for fattening rabbits

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In order to assess the inclusion of 0, 10, 20 and 30 % of dehydrated distillery grains with solubles (DDGS) in diets for fattening rabbits, 56 animals (Black Aztec x Chinchilla) of 40 d of age were used. The productive performance from weight gains, feed conversion, viability, feed intake, mean daily gain, carcass yield, meat, bones and fat of the rabbits was determined, as well as the yield of edible viscera. The viability was of 100 % in all the treatments. The rabbits consuming the diet with 10 % of DDGS consumed less feeds (91.8 g/rabbit), and determined better feeding conversion index (4.21). Those animals receiving the diet with 20 % of DDGS obtained higher weight (2051 g/rabbit). The carcass yield did not differ significantly between treatments. The rabbits with 30 % of DDGS in the diet achieved higher yield in edible viscera (8.8 %). The neck yield was higher in those with 20 % of DDGS in the diet (4.9 %). There were no significant differences for meat and fat yield in the carcass. The inclusion of up to 20 % of DDGS in feedstuff for fattening rabbits is possible without altering the carcass yield.

Key words: *DDGS, fattening rabbits, productive performance, carcass yield.*

The bio-fuel production, particularly that of ethanol from maize, has notably developed in the United States of America as a response to the necessity of depending less on the oil (Shurson 2007). As a by-product of this process, dehydrated distillery grains with soluble (DDGS) are obtained. In 2007, there was a production of 15 millions of DDGS (Hayes 2008 and Paulson 2008), and for 2015-2016, productions between 40 and 88 millions of tons a year are expected (Tokgoz *et al*. 2007).

The animals consuming most this by-product in the USA are the ruminants, with a consumption of 42 % in dairy cattle and 42 % in meat cattle. Pigs are the next, with 11% of intake and birds, with at about 5 % (Fox 2008). However, in rabbits feeding, the use of DDGS seems to be much reduced in the literature consulted there is a scarce recommendation referred to the use of dry distillery grains with solubles in USA (USGC 2007), with the possibility of including up to 20 % of DDGS for pet rabbits. This criterion is based on a study of Villamide *et al*. (1989) about the digestibility in rabbits. Another study of Bernal *et al*. (2010) refers that the fattening rabbits behave properly with 10 and 20 % of DDGS.

Due to the lack of scientific information on the use of DDGS of maize in diets for fattening rabbits, the objective of this paper was to assess the effect of including 0, 10, 20 and 30 % of them in fattening rabbits' diets.

Materials and Methods

The research was conducted in the rabbit facilities of the unit "La Ascensión", in Aramberri, N.L., of the Agronomy Faculty, Authonomous Univeristy of Nuevo Leon, Mexico, from October 20th to December 15th, 2009.

A total of 56 rabbits of the hybrid Black Aztec x Chinchilla were used. The animals were just weaned and 40 d of age and they were allocated at a rate of two rabbits per cage. They received feeds in a round feeder four times a day (8:00 a.m., 11:00 a.m., 2:00 p.m. and 5:00 p.m.). The inclusion levels of the DDGS in the diet were: 0, 10, 20 or 30 %. The composition and contribution calculated in the diets are shown in table 1.

The productive indicators initial and final liveweight, mean daily gain from weaning to slaughtering (96 d of age), feed intake and feeding conversion were measured. For knowing the real consumption, the remainders were collected everyday and weighed in a digital balance (Torrey, México), with capacity of 50 kg and 10 g precise. Daily feed intake was determined by difference between offer and rejection. Water was offered *ad libitum*.

At the end of the fattening, 40 rabbits (10 per treatments) were slaughtered, skinned and their viscera removed without previous fasting. The hot carcass (except blood, lungs, genital organs, viscera, urinary bladder and skin) (Gondret *et al*. 2005) was weighed to determine the carcass yield and that of the edible viscera (liver, heart, kidneys and spleen). Later, the carcasses of 20 rabbits (5 per treatment) were boned to determine the yield in meat, bone and fat.

The slaughtering method applied for killing the rabbits was contusion. The animal was hit in the head, in the upper part of the neck, the occipital region. The death was confirmed when the blood circulation stopped (Close *et al*. 1997).

Table1: Composition and calculated contribution of the diets

Ingredients	0 % DDGS	10 % DDGS	20 % DDGS	30 % DDGS
Alfalfa meal	50.40	49.10	53.90	55.30
Sorghum grain	30.00	26.94	17.20	10.40
Soybean meal	13.70	9.60	4.60	0.00
DDGS	0.00	10.00	20.00	30.00
Molasses	3.00	3.00	3.00	3.00
Monocalcic phosphate	0.68	0.54	0.46	0.36
Common salt	0.50	0.50	0.50	0.50
Premixture Vit + Min trace	0.20	0.20	0.20	0.20
DL Methionine	0.14	0.14	0.14	0.14
L-lysine	0.00	0.00	0.02	0.12
Soybean oil	1.40	0.00	0.00	0.00
Total	100.00	100.00	100.00	100.00
Calculated contribution				
Crude protein, %	17.41	17.41	17.43	17.42
Crude fiber, %	17.43	17.57	19.46	20.36
ADF, %	21.66	22.87	25.91	27.88
NDF, %	29.10	33.05	38.34	42.73
Digestible energy, kcal/kg	11704.00	11704.00	11699.82	11837.76
Total phosphorous, %	0.45	0.45	0.45	0.45
Calcium, %	0.88	0.85	0.90	0.91
Lysine, %	0.77	0.71	0.65	0.65
Methionine + Cystine, %	0.60	0.60	0.60	0.60

The DDGS used in the test is certified as with good nutritive quality, free of toxic levels of mycotoxins, according to the data recorded in the quality controls of the industry.

Analysis of variance according to completely randomized design with four treatments and seven repetitions per treatment was conducted. The repetitions were constituted for metallic cages with two rabbits, a feeder and a drinker. The software INFOSTAT, version 1.0 (Balzarini *et al*. 2001) was used for the statistical processing. The differences between means were determined according to Duncan (1955).

For the statistical analysis of carcass yield, edible viscera yield, as well as that of meat, bone and carcass fat, a completely random design with four treatments and five repetitions (one per each slaughtered animal) was used.

Results and Discussion

The viability in the four treatments assessed was of 100 % (table 2), showing the innocuousness of the diets elaborated with the DDGS.

The rabbits consuming the diet with 10 % of DDGS had less feed intake (91.8 g/rabbit), determining the best feeding conversion index (4.21). It did not differ significantly from that reached in rabbits with inclusion levels of 0 and 20 % of DDGS (4.46 and 4.23), but did from those with 30 % (5.23). However, the animals with 20 % of DDGS in the diet had the highest final weight (2051g/rabbit), surpassing 2 kg internationally established and in Cuba for marketing fattening rabbits. In this treatment, the animals reached higher gain of total and daily liveweight, without differing significantly from the diets with 0 and 10 %. Although there were differences in respect to the 30 % inclusion level of DDGS, it is not the best level recommended (table 2).

Shurson *et al*. (2000), in studies conducted in Jalisco and Veracruz, Mexico, obtained similar results to those of the control and sometimes better when using 10 % of DDGS in the diet of growing pigs. De Decker *et al*. (2005) referred smaller weight gain and higher feed conversion with 25 % of DDGS in growing pigs, so they recommended the additing up to 20 % of this ingredient in the diet. The USGC (2007) users' manual also recommends 20 % of DDGS inclusion in the diet for rabbits, with good use.

Burkey *et al*. (2008), Martínez (2011) and Lee *et al*. (2012) did not find productive disorders when introducing 30 % of DDGS in diets for growing-fattening pigs.

When DDGS without mycotoxins are used in animal feeding, the immunity is expected to increase as they have manano-oligosaccharides in the yeasts

Table 2. Productive indicators of fattening rabbits fed with three levels of DDGS

Indicators	Levels of DDGS, %				SE±Sign
	0	10	20	30	
Viability	100.0	100.0	100.0	100.0	-
Initial liveweight, g	763.0	761.0	751.0	734.0	39.0
Final liveweight, g	1984.0	1997.0	2051.0	1791.0	86.0
Gain, g	1221.0^{ab}	1236.0^{ab}	1299.0^{a}	1056^{b}	64.0*
DMG, g/d	21.8^{ab}	22.1^{ab}	23.2^{a}	18.9^{b}	1.3*
Feed intake, g/d	95.4	91.8	96.4	96.7	3.2
Feeding conversion	4.46^{a}	4.21^{a}	4.23^{a}	5.23^{b}	0.18*

^{a,b} Means with different superscripts in each row differ significantly at P < 0.05 Duncan (1955)
* P < 0.05

wall (Upendra and Yathiraj 2003, Miazzo *et al*. 2005 and Morales 2007), together with the contribution of nucleotides of the yeasts (Rutz and Mollet 2009) and the presence of essential fatty acids from the maize DDGS' oil (Hemke 2009 and Rutz and Mollet 2009).

The carcass yield did not differ significantly between treatments. The rabbits consuming the diet with 30 % of DDGS reached higher yield in edible viscera (8.8 %), which did not differ significantly from those consuming 20 % (8.3%), but differing from those with 0 and 10 % (7.1 and 7.0 %). The neck yield was higher in the rabbits fed 20 % of DDGS (4.9 %), and differed significantly from that obtained in rabbits consuming 0 and 10 %. There were no significant differences for the yield of meat and fat in the carcass. The total bone of the carcass was higher in the rabbits fed 20 % of DDGS, differing significantly from that reported for the animals fed the rest of the diets. All these could be because these rabbits had the lowest total meat (table 3).

Whitney *et al*. (2006) achieved higher carcass yield in pigs fed diets with 0 and 10 % of DDGS, in respect to the animals consuming 20 and 30 %.

The results refering to the carcass differences vary in respect to the reports of other authors, mainly in the carcass parts. This could be attributed to some factors affecting these characteristics not considered in this study, as environmental temperatura and season.

In respect to the last, Dalle (2002) referred that in rabbits, the increase of environmental temperature over the thermo-neutrality values reduces feed intake and, thus, diminishes growth rate. This prokes low slaughtering weigth, more evident in summer.

The age of the rabbits at slaughtering is another factor that may influence on the carcass means (Piles *et al*. 2000, Dalle 2002 and Gondret *et al*. 2002). Likewise, Metzger *et al*. (2003) consider that assessing the carcass characteristics with the same body weight is more important, as it is a relevant factor influencing on the variation of the carcass parts' weight.

A higher size of the vital organs could be an indicator of higher basal metabolism, with possible growth and feed use affection (Mader *et al*. 2009). This could explain the reduction of the daily mean gain (DMG) of rabbits fed 30% of DDGS.

It is concluded that including up to 20 % of DDGS in the feedstuff for fattening rabbits is possible without altering their productive performance.

Table 3. Carcass, meat, bone and fat yields of fattening rabbits fed four levels of DDGS

Indicators	Levels of DDGS, %				SE±Sign
	0	10	20	30	
Carcass yield, %	47.7	48.6	46.0	49.7	1.8
Edible viscera yield, %	7.1^{a}	7.0^{a}	8.3^{ab}	8.8^{b}	0.5*
Neck yield, %	3.1^{ab}	2.5^{a}	4.9^{c}	4.2^{bc}	0.4**
Total yield, %	57.2	56.2	58.4	60.2	1.6
Carcass's total meat, %	64.0	65.2	60.6	64.7	1.3
Carcass's total bone, %	30.0^{a}	30.5^{a}	35.8^{b}	30.1^{a}	1.5*
Carcass's total fat, %	6.0	4.3	3.6	5.2	0.8

^{a,b,c} Means with different superscripts in each row differ significantly at P < 0.05 Duncan (1955)
* P < 0.05
** P < 0.01

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