Determination of nitrogen digestibility and metabolizable energy of a blend of sorghum with three levels of particle size and addition of an enzyme complex in poultry

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ABSTRACT

In order to evaluate the effect of the addition of an enzyme complex (CE) to three levels of a mixture of grain sorghum (BS) on nitrogen digestibility and metabolizable energy in adult roosters and broilers was carried out two experiments (Exp.), using in Exp. I, 56 adult roosters Bovans Brown line and in Exp. II, 42 Ross broiler hybrid 308 in the completion phase with 33 day old. We used a completely randomized design with factorial arrangementwith six treatments (100% BS with three levels of grading) and the presence of CE (with or without CE), with eight adult roosters per treatment (Experiment I) and six broilers per treatment (Exp.II). We determined the true digestibility of nitrogen and true metabolizable energy. Result showed, no significant differences were found for the variables of particle size and presence or absence of EMV CE in the two experiments. There were differences ($P < 0.01$ and $P < 0.001$) for the particle size factor (87.7 ± 2.31) and interaction with CE (82.9 ± 3.45) respectively, on the DVN in Exp. I, in Exp. II there was no effect of the two variables on the DVN. The values of EMV and DVN in Exp. II were always lower than those obtained in Exp. I. We conclude that the results obtained allow us to differentiate the needs for each bird, thus avoiding overestimation of the energy content and digestibility of nitrogen. As well as, particle size mix of sorghum between 3 and 5mm are more suitable for birds.

Keywords*: particle size, digestibility, metabolizable energy, the enzyme complex*

INTRODUCTION

In Venezuela the cultivation of sorghum (Sorghum bicolor L. Moench.) Represents one of the most important agricultural lines in the country, as it is a large grain of uses, prospects and high adaptability to different climatic conditions (Gonzalez et al ., 1999). However, it has within its chemical constituents, condensed tannins (CT), to which have been given responsibility for reducing the nutritional value of grain when used in diets for monogastric animals, on the other hand, condensed tannins affect functioning of the endogenous enzymes, mainly trypsin and amylase, key enzymes to digest the nutrients required by animals, so that decreases the digestibility of nutrients causing a deterioration of the productive parameters (Duodu et al., 2003; Seal et al., 2010). Furthermore, exogenous enzymes that help digestibility of foods such as SSF (solid state fermentation) an enzyme complex (EC) derived from Aspergillus niger which is constituted of seven enzymes: amylase, cellulase, phytase, xylanase, beta-glucanase, pectinase, protease, which act synergistically to increase the availability of energy, protein, amino acids, calcium and phosphorus from plant sources (Morales and Quezada, 2008). In this sense, the aim of this research was to evaluate the effect of the addition of an enzyme complex to three levels of fineness of a blend of sorghum (BS) on the digestibility of nitrogen and metabolizable energy in adult roosters and broilers.

MATERIALS AND METHODS

The experiment was conducted on the premises of the Institute of Animal Production, Poultry Section Laboratory, Faculty of Agronomy, Central University of Venezuela, with an average temperature of 25 ° C and a relative humidity of 75% (INIA, 2010). We used a completely randomized design with 3 x 2 factorial arrangement, corresponding to the treatment provided (mixture of sorghum grain with three levels) and the presence of EC (with or without EC). Appropriate treatments are: T1 = CE + C BS No 1 mm, T2 = BS with CE + 1 mm, T3 = BS No EC + C 3mm, T4 = BS with CE + C 3mm, T5 = BS No EC + C 5mm T6 = BS with CE + C 5mm [EC = enzyme complex. Adding EC (0.02%). C = Screen. BS = Mixture of sorghum]. The work was carried out in two experiments, using in Experiment I, 56 adult roosters line Bovans Brown (Methodology Sibbald, 1976) and in Experiment II, 42 Ross broiler line 308 in the finisher phase (methodology Lessire, 1990) with an average weight at 33 days of 1511.31 g. For the collection of feces was carried out in trays for 48 h (Experiment I) and 72 h (Experiment II) and then placed in aluminum trays where they were weighed and dried in an oven with circulating air at 65 ° C for 48 hours. Then he proceeded to perform the calculations of the true digestibility of nitrogen (DVN) and true metabolizable energy (TME). For analysis of the data variance analysis was performed to obtain the results with mean and standard error. In those variables which yielded significant differences ($P < 0.05$), we proceeded to perform the respective test procedure means using the Tukey (Steel et al., 1997).

RESULTS AND DISCUSSION

In relation to the EMV (Kcal / kg / BS), Table 1, we found that for adult roosters with maximum and minimum values of 3830.47 and 3705.19 respectively, where, no evidence of any effect of the two variables as they were, the three levels of grain sorghum mix (BS) and the presence or absence of the enzyme complex. Also in the case of broilers, EMV values were obtained (kcal/kg/BS) 2904.43 maximum and minimum and 2723.17 respectively, as in the adult roosters, no significant effect for both variables. However, one can observe that in the latter case the GSS is less compared to the MLE for roosters. This is similar to the results of Bourdillon et al. (1990) where the values of apparent metabolizable energy corrected to zero nitrogen balance (AMEn) of the experimental diets were significantly lower when measured with the young birds.

Table 1. True metabolizable energy (TME) of the treatment provided for adult roosters and broilers

Treatments	TME - Roosters (Kcal/kg/MS)	TME - Broilers (Kcal/kg/MS)
T1 = BS Sin CE + C 1mm	3705,19 ± 89,38	2755,53 ± 104,93
T2 = BS Con CE + C 1mm	3814,75 ± 82,36	2723,17 ± 101,00

T3 = BS Sin CE + C 3mm	3713,90 ± 89,67	2904,43 ± 243,72
T4 = BS Con CE + C 3mm	3830,47 ± 57,37	2885,19 ± 117,23
T5 = BS Sin CE + C 5mm	3816,86 ± 81,19	2833,40 ± 117,56
T6 = BS Con CE + C 5mm	3829,75 ± 40,25	2826,72 ± 83,20

Factor	***Probabilidad***
Particle size	ns
Presence of EC	ns
Particle size x Presence of EC	ns

Values expressed as mean ± standard error of the mean. ns = not significant. EC = Enzyme Complex. C = Screen. BS = Blend sorghum. Subscripted with different letters within the same row indicate significant differences (P <0.05).

Table 2, shows the values of DVN (%) in adult roosters, finding significant effects (P <0.01) for the particle size factor and the interaction between particle size and enzyme complex (P <0.001). In the first case, the blend of sorghum grinding with a sieve of 3 mm was obtained in which less DVN (%). Moreover, regarding the interaction, DVN T4 obtained (%) lower, showing a decrease of 5% in relation to particle size with sieve of 3 mm, also in this treatment the standard error was 3.45 % being superior this, compared to the following treatments and most DVN (%). In other results, Ravindran et al. (1999) evaluated the addition of phytase in diets based on sorghum, obtaining an improvement in digestibility, as Jimenez (2000) where enzyme supplementation of diets based on sorghum and corn.

Table 2. True digestibility of nitrogen (TDN) of treatments provided to adult roosters

Factor Particle size	**TDN (%) Roosters**
BS + C 1 mm	91,97 ± 1,1[a]
BS + C 3 mm	87,7 ± 2,31[b]
BS + C 5 mm	93,92 ± 1,16[a]
Probabilidad	< 0,01
Factor Presence of EC	
Without enzyme complex	92,04 ± 0,67
With enzyme complex	90,33 ± 2,00
Probabilidad	ns
Particle size x Presence of EC	
T1 = BS Sin CE + C 1mm	91,74 ± 1,35[a]
T2 = BS Con CE + C 1mm	92,34 ± 2,07[a]
T3 = BS Sin CE + C 3mm	93,19 ± 1,19[a]
T4 = BS Con CE + C 3mm	82,9 ± 3,45[b]
T5 = BS Sin CE + C 5mm	91,32 ± 0,93[a]
T6 = BS Con CE + C 5mm	96,51 ± 1,71[a]
Probabilidad	< 0,001

Values expressed as mean ± standard error of the mean. ns = not significant. EC = Enzyme Complex. C = Screen. BS = Blend sorghum. Subscripted with different letters within the same row indicate significant differences (P <0.05).

CONCLUSION

Under the conditions of the experiments, the three levels of grading and the addition of the enzyme complex did not produce effects on metabolizable energy and nitrogen digestibility in broilers and roosters. The results obtained allow differentiating the needs for each bird thus avoiding overestimation of the energy content and digestibility of nitrogen, favoring blend of sorghum grain sizes between 3 and 5 mm.

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