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Level of Agave Inulin in the Feed and the Performance of Rabbits

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Abstract: The oligosaccharides that are present in the feed modulate the development of microflora, which in turn helps the animal performance. *Agave tequilana* azul Weber plant in primarily use to produce beverage tequila and is a source of the fructo-oligosaccharide inulin. Three levels (0, 1, or 2%) of agave inulin were added to the feed of eighteen male rabbits to assess the performance and organ changes. The addition of the agave inulin reduced the intake but the average daily gain was similar among levels ($p>0.05$). Digestive tract associated organs were not affected by the level of inulin in the feed ($p>0.05$). Therefore, using 2% of agave inulin can affect positively the rabbit digestive tract.

Key words: Rabbit, performance, internal organ, *Agave tequilana*, inulin

INTRODUCTION

Systemic response of the animal reflects the protection of the intestine mucosa against pathogen bacteria and tissue integrity (Kleessen *et al*., 2001). Some researchers (Campbell *et al*., 1997; Flickinger *et al*., 2003; Kleessen and Blau, 2005; Le Blay *et al*., 1999; Volek *et al*., 2007) have shown that it can be managed with the use of indigestible nutrients of the ingredients such as oligosaccharides. Oligosaccharides influence the composition of the bacterial populations in the intestine of a number of animal species (Bónai *et al*., 2008; Falcão-e-Cunha *et al*., 2007; Flickinger *et al*., 2003; Grizard and Barthomeuf, 1999; Le Blay *et al*., 1999; Parks *et al*., 2001; Rycroft *et al*., 2001; Van Loo, 2007; Verdonk *et al*., 2005; Volek *et al*., 2007; Yalcinkaya *et al*., 2008; Yusrizal and Chen, 2003).

Inulin is a fructose oligosaccharide that can be found in plants such as wheat, onion, bananas, garlic and chicory (Flickinger *et al*., 2003). Commercial available inulin is synthesized from sucrose or extracted from chicory (Flickinger *et al*., 2003; Rycroft *et al*., 2001; Van Loo, 2007). In México the *A. tequilana* azul Weber agave plant (31.0-31.5% of dry matter, 1.3-1.4% protein, 1.7-1.9% minerals (ash), 22.3-22.7% of total carbohydrate and 3-10% of fructo-oligomeres, quite similar in the heart of agave and the leaves (Praznik *et al*., 2002)) is primarily use for tequila production, but also is a source of inulin. Furthermore, no research articles were found on the use of agave inulin in the rabbit performance and organ impact.

MATERIALS AND METHODS

Eighteen New Zealand x California x Rex male rabbits (average initial weight of 350 g) were individually housed in metallic cages (40×40 cm) with plastic floor. Rabbits were given free access to feed formulated to meet daily requirements and was measured daily. Agave inulin was obtained locally (Inulina y Miel de Agave, SA de CV). The inulin treatments were; 0, 1 or 2% addition (dry matter basis) to the feed. Animals were weighted at the start and assigned at random to the three treatments. Environmental conditions were as follows: temperature 16-18°C, relative humidity 60-65%.

On day 66 of the experiment, final body weight was measured using a portables electronic scale. All animals were humanly slaughtered under the supervision of a certified veterinarian. The internal organs and digestive tract were removed immediately and weighted. Digestive tract was thoroughly rinsed with the isotonic solution and died using paper towels. Dry matter of feed was determined by drying samples at 70°C for 24 h. Data were analyzed as a randomized trial using the SAS package and using a 0.05α to declare differences among treatments and when they existed the Duncan procedure was used to separate the means.

RESULTS AND DISCUSSION

The consumption of dry matter by the rabbit use in the trial was reduced (averaged 95.83 g day^{-1}; $p<0.05$; Table 1) with the addition of *Agave tequilana* Weber

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Table 1: Rabbit performance and internal organ wet weight variation with agave inulin

Wet weight variation	Agave inulin (%) in the feed (g) 0	1	2	p<0.05
Dry matter intake	107.21a	88.20b	92.09b	*
Daily gain	25.73a	24.67a	30.53b	*
Carcass	811.23a	724.18b	847.09a	*
Stomach	20.49a	17.70b	20.57a	*
Intestine				
Small	28.74a	23.19b	30.46a	*
Large	24.21a	20.19b	25.03a	*
Cecum	23.70a	17.83b	23.91a	*
Pancreas	2.21a	2.05a	2.06a	NS
Liver	64.69a	61.72a	64.53a	NS
Spleen	1.65a	2.03a	3.50b	*
Kidney	15.32a	15.35a	17.11a	NS
Lungs	12.69a	14.29a	13.51a	NS
Heart	4.88a	5.80a	5.46a	NS

Means with the different letter within the row are statistically different (p<0.05)

nulin to the feed. Average daily gain was 28.025 g and with the addition of 1% of inulin it was reduced, but with 2% of the oligosaccharide the gain was higher than control (0, 1 and 2% of agave inulin; g day^{-1}, respectively; p<0.05).

With 4% of chicory inulin in the feed Volek *et al.* (2007) reported 33.3 g and Bolai 36 g of daily gain in rabbits, a bit higher to the results observed in the present trial with of agave inulin.

The carcass weight was in average 795.91 g and was reduced with the addition of 1% of inulin (p<0.05) and further increased with the 2% (Table 1). Similar behavior was observed on the stomach, small and large intestine and cecum.

Trautwein *et al.* (1998) using hamsters reported higher cecum weight with the use of increasing levels of chicory inulin. On the other hand, Volek e*t al.* (2007) using rabbits fed 4% chicory inulin reported that cecum weighed 34.5 g, higher than the observed with 2% agave inulin. There was a lack of effect of the agave inulin on the weight of pancreas, liver kidney, lungs and hart (p>0.05), but increased the spleen weight (p<0.05) of the experimental rabbits.

CONCLUSION

Agave inulin can be use in rabbit feeding at 2% with no adverse effect on performance or internal organs.

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