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Inclusion of *Yucca schidigera* extract and zeolite in the diet and its relationship to the apparent digestibility of nutrients and urinary pH in adult dogs

Inclusão do extrato de *Yucca schidigera* e da zeólita na dieta e sua relação com a digestibilidade aparente dos nutrientes e pH urinário de cães adultos

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— NOTE —

ABSTRACT

This study aimed to evaluate the inclusion of *Yucca schidigera* extract and zeolite (Clinoptilolite) added to the diets for dogs and its effect on apparent digestibility coefficients (ADC) of diet components (dry matter, organic matter, crude protein, acid hydrolyzed fat, and energy) and urinary pH. Twenty-one adult Beagles, males and females, body weight mean of 12.5±1.5kg and four and a half years old, distributed in a completely randomized design with seven replicates per treatment within three experimental treatments: control (no addition of *Yucca schidigera* and zeolite), *Yucca schidigera* (375ppm) and zeolite (1%), administered in the encapsulated form of the supplement. The ADC of diet components and urinary pH were not affected by the inclusion of additives ($P>0.05$), except the ADC acid hydrolyzed fat showed reduction with *Yucca schidigera* supplementation compared to the other treatments ($P<0.05$). The addition of 375ppm of *Yucca schidigera* extract reduced the digestibility of dietary fat by dogs and both *Yucca schidigera* extract and zeolite did not affect the urinary pH of dogs.

Key words: canines, clinoptilolite, nutritional additives, saponin.

RESUMO

O objetivo deste trabalho foi avaliar a inclusão do extrato de *Yucca schidigera* e da zeólita (Clinoptilolita) nas dietas para cães e seus efeitos sobre os coeficientes de digestibilidade aparente (CDA) dos componentes da dieta (matéria seca, matéria orgânica, proteína bruta, extrato etéreo em hidrólise ácida e energia) e no pH urinário. Foram utilizados 21 cães Beagles, machos e fêmeas, com peso médio de 12,5±1,5kg e quatro anos e meio de idade, distribuídos em delineamento inteiramente casualizado com sete repetições para cada um dos três tratamentos experimentais: controle (sem adição de *Yucca schidigera* e zeólita), *Yucca schidigera* (375ppm) e zeólita (1%),

administrados na forma de suplemento encapsulado. Os CDA dos componentes da dieta e o pH urinário não foram afetados pela inclusão dos aditivos ($P>0,05$), exceto o CDA do extrato etéreo em hidrólise ácida, que reduziu com a suplementação de *Yucca schidigera* em comparação aos demais tratamentos ($P<0,05$). A adição de 375ppm de extrato de *Yucca schidigera* reduziu a digestibilidade da gordura dietética pelos cães e tanto a adição de *Yucca schidigera* como a de zeólita não alteraram o pH urinário.

Palavras-chave: aditivos nutricionais, caninos, clinoptilolita, saponina.

Brazil is one of the main producers of feed for dogs and cats, with a wide range of formulations and commercial options (economic, standard, premium, and super premium feed). Because the market has an increasing demand for foods with specific purposes, the inclusion of various additives is required. Fecal odor reducers are of great importance, since the odor of feces is an inconvenience when humans and dogs share the same environment.

Yucca schidigera extract and zeolite are among the main additives that act to reduce fecal odor. Relatively few studies have evaluated the use of these additives in animal feed production. These studies have focused on the measurement of animal performance and nitrogen metabolism, and the results were conflicting (SHURSON et al., 1984; ÇABUK et al., 2004; PRVULOVIC et al., 2007). Studies evaluating the effect of these additives on the digestibility of nutrients

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in the diet and the urinary pH of dogs are scarce. Such studies are important to validate the inclusion of these ingredients in commercial formulations. This study aimed to evaluate the effects of including *Yucca schidigera* and zeolite (Clinoptilolite) in commercial feed for adult dogs on the apparent digestibility and urinary pH of dogs.

The study was performed at the Center for Studies on Nutrition of Companion Animals (CENAC) in the Department of Animal Science (DZO), at the Universidade Federal de Lavras (UFLA). Twenty-one healthy male and female Beagles, body weight mean of 12.5 ± 1.5 kg and four and a half years old were used. The study was conducted by using a randomized design consisting of three treatments: control (no addition of *Yucca schidigera* and zeolite); *Yucca schidigera* (375 ppm) or zeolite (Clinoptilolite) (1%), calculated on a dry matter (DM) basis, and included seven dogs in each treatment group.

To develop the experimental test, a standard commercial feed (Table 1) was used according to the classification of the Brazilian Association of Products for Pets (ABINPET, 2008). None of the additives studied were included in the composition. The additives were administered by using gelatin capsules (Vittara-Manipulation Pharmacy, Lavras/MG), which were also supplied to the control group as placebos.

The amount of feed provided to the dogs was determined by using the NRC (2006) predictive formula: $200 \times (\text{body weight})^{0.75} = \text{kcal day}^{-1}$. The dogs were fed once daily, in the morning at 8 o'clock, and the capsules were administered jointly. The capsules containing the additives were administered according to the amount of feed provided to each dog. Water was provided *ad libitum* throughout the study.

The dogs were allowed to adapt to the experimental diet for 5 days, and then feces were collected. The feces were weighed, wrapped in plastic bags, and stored in a freezer (-20°C) until processing, according to the recommendations of the Association of Official Analytical Chemists (AOAC, 1995). The dogs remained in the metabolic cages after feces collection, and urine was collected for a period of 72h. Urine pH was determined every 24h by using a digital pH meter (QUIMIS, model Q400A). To conserve and prevent deterioration of the urine, polystyrene foam boxes with collecting bottles immersed in ice were installed.

The data were analyzed and the normality of residues and the homogeneity of variances were verified by using the Statistical Analysis System (SAS, version 9.2). PROC GLM was used to analyze parametric statistics and the Student-Newman-

Keuls (SNK) test was used to compare means at a significance level of 5%.

No significant differences ($P > 0.05$) were observed in the apparent digestibility coefficients (ADC) of dry matter, organic matter, crude protein, gross energy, or apparent digestible energy of the diets (kcal kg^{-1}) between the experimental treatments (Table 2). These findings corroborate those reported by MAIA et al. (2010) and REIS et al. (2016), who used *Yucca schidigera* and zeolite and only *Yucca schidigera*, respectively, in dogs, and those reported by ROQUE et al. (2011), who used *Yucca schidigera* and zeolite in cats. However, the inclusion of the additive *Yucca schidigera* had an effect on the ether extract in acid hydrolysis ($P < 0.05$), with a reduction of 4.5 percentage points compared to the control group, and 5.5 percentage points when compared to the group supplemented with zeolite.

CHEEKE (2000) reported a reduction in the digestibility of fat when *Yucca schidigera* extract was added, due to its interaction with bile salts. HAN et al. (2000), who performed a study in mice using *in vitro* purified saponin from *Radix Platycodi*, the *Platycodon grandiflorum* root, demonstrated inhibition of pancreatic lipase activity. However, such assessments were not performed in the present study. It is important to highlight that differences exist between saponins. The *Yucca schidigera* extract has a steroidal chemical structure, whereas the saponin from *Radix Platycodi* has a triterpenoid structure, and these variations could result in different effects.

The findings in this study corroborate those of BERGERO et al. (1995), who observed that the addition of 120 ppm of *Yucca schidigera* to rabbit diets resulted in the reduction of ether extract

Table 1 - Nutritional composition of the experimental diet obtained through chemical analysis.

Nutrients (%)	Laboratorial Analysis ¹
Crude protein	19.9
Ether extract in acid hydrolysis	7.7
Crude fibre	2.2
Mineral matter	7.8
Calcium	1.9
Phosphorus	1.4
Metabolizable energy (kcal/kg)	3,805

Composition: Brewers rice, ground whole corn, poultry meal, meat and bone meal, stabilized animal fat, brewers dried yeast, hydrolyzed chicken, corn gluten meal 60, wheat bran, dehydrated potato, flaxseed, sodium chloride, potassium chloride, dyes, calcium phosphate, and a vitamin-mineral premix. ¹On a dry-matter basis.

Table 2 - Mean values for digestibility coefficients of the nutritional components, energy and urinary pH.

Item (%)	-----Experimental treatment-----			CV	P
	Control	<i>Yucca schidigera</i>	Zeolite		
Dry matter	78.33	80.39	79.75	2.75	0.2210
Organic matter	82.04	83.94	83.86	2.43	0.1481
Crude protein	78.41	80.08	80.78	3.32	0.2429
Ether extract in acid hydrolysis	84.51 ^a	79.98 ^b	85.44 ^a	4.42	0.0461
Crude energy	82.04	83.94	83.96	2.89	0.2900
Digestible energy (kcal kg ⁻¹)	3,731	3,772	3,840	2.92	0.2527
Urinary pH	7.55	7.44	7.65	5.81	0.7241

The letters following the means indicate significant differences by the SNK test at the 5% significance level. Control = no addition of *Yucca schidigera* or zeolite; *Yucca schidigera* = addition of 375ppm; zeolite = addition of 1.0%.

digestibility. However, MAIA et al. (2010) and REIS et al. (2016), when working with diets containing high and intermediate levels of ether extract in acid hydrolysis (22.72%; 10.61% and 10.72% on DM basis, respectively) observed no effect on the digestibility of fat in dogs.

No differences ($P > 0.05$) were observed in the urinary pH of the dogs (Table 2), which is consistent with the findings of ROQUE et al. (2011) and REIS (2012). The urinary pH values found in this study were similar to those reported by NOGUEIRA (2010) when evaluating commercial diets for dogs from the same commercial type (standard).

Although the inclusion of *Yucca schidigera* and zeolite had no effect on the urinary pH of dogs, the digestibility of fat was reduced with the inclusion of *Yucca schidigera* extract in the diet. Thus, the composition of essential fatty acids in low-fat diets that include *Yucca schidigera* must be considered in order to ensure that nutritional deficiencies do not occur.

BIOETHICS AND BIOSSECURITY COMMITTEE APPROVAL

This study was approved by the Bioethics Committee on Animal Use from UFLA (Protocol number: 029/2009).

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