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EFFECT OF THE PARTICLE SIZE OF COAST CROSS HAY (*Cynodon dactylon*) ON PERFORMANCE AND DIET DIGESTIBILITY IN GROWING RABBITS.

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ABSTRACT

Four diets containing 32% Coast cross hay were fed *ad libitum* to 64 rabbits in order to study the effect of particle size on performance (32 – 72 days) and digestibility in growing rabbits. Diets differed only in particle size of Coast cross hay; average particle size was 0.461; 0.635; 0.969 and 1.273mm, respectively. A linear significative effect ($P<0.01$) was observed for total weight gain (1,330; 1,182; 1.150 and 1,083g) and daily weight gain (33.3; 29.6; 28.8 and 27.1g) with increasing particle size, while feed conversion (3.40; 3.44; 3.79 and 3.80) was significatively affected at $P<0.05$. Digestibility coefficients were not influenced except for acid detergent fiber ($P<0.05$). The average particle size of 0.461mm resulted in a better weight gain and feed conversion.

INTRODUCTION

The rabbit is an herbivorous animal and it is adapted to roughage feed intake. Although several studies had demonstrated that this species has a relatively limited ability to digest fiber (SLADE & HINTZ, 1969; CHEEKE et al. 1986). The presence of fiber in adequate levels in rabbit diets is very important, because it normalize the function of the digestive system, acting mainly through its less digestive constituents.

According to DE BLAS et al. (1986) the digestibility of fiber by rabbits is related with its source, particle size and level. Particle size can influence the digestive process. According to many authors (LAPLACE LEBAS, 1977; AUVERGNE, et al.1988), the smaller particles remain longer in the caecum providing a higher bacterial digestion of the diet.

The aim of the present work was to study the effect of Coast cross hay's particle size on performance and diet digestibility in growing rabbits.

MATERIAL AND METHODS

A diet was formulated (Table 1) having as main fiber source Coast cross hay which was previously grounded in a hammer mill, using sieves with holes of 3.0; 5.0; 7.0 and 9.0mm of diameter. The mean particle size was determined according to HANDERSON & PERRY (1955) technique. The diets were pelleted with mean size of 4.7 mm of diameter and 8.0 mm in length. The resulting average particle size (APS) in the 4 diets was 0.461mm; 0.365mm; 0.969mm and 1.273mm. The chemical composition of the diet is presented in Table 2.

In the performance trial, it was used 32 crossbreed rabbits (New Zealand White x Californian) of both sexes, weaned at 32 days, with an average weight of about 683g. They were randomly placed in individual cages, being distributed in a randomised design with four treatments and

eight repetitions. The experimental period was during 40 days, where the animals were given water and meal ad lib. Pellet's intake, weight gain and mortality among the treatments were registered.

Table 1- Experimental diet used for rabbits.

Ingredients	Percentage composition
Corn	30.71
Soybean Meal	15.29
Wheat bran	15.40
Coast- cross hay	32.00
Bone and meat meal	6.00
Salt	0.40
Premix[1]	0.20

[1]Composition for kg: Fe, 180.0g; Cu, 20.0g; Co, 4.0g; Mn, 80.0 g; Zn, 140.0g; Vit. A, 10,000,000 UI; Vit. D3, 100,000 UI; Vit.E, 1,200mg; Vit. B1, 329mg; Vit. B2, 360mg; Pant. Acid, 2,900mg; Vit. B12, 0.06mcg; Vit. B6, 3,920mg.

Table 2- Chemical composition of the experimental diets (%) based on dry matter.

	Average particles size			
Nutrients	0.461mm	0.635mm	0.969mm	1.273mm
Dry matter (DM)	87.53	88.17	88.00	87.78
Crude protein (CP)	21.88	21.47	20.50	21.57
Mineral matter (MM)	7.39	7.38	7.33	7.56
Crude fiber (CF)	11.70	12.01	12.53	11.69
Acid detergent fiber (FDA)	16.69	15.39	16.10	15.47
Neutral detergent fiber NDF)	35.92	37.51	37.70	37.63
Organic matter (OM)	92.61	92.62	92.67	92.44
Gross energy [1](GE)	4.42	4.30	4.34	4.38
Calcium (Ca)	1.30	1.32	1.25	1.36
Phosphorus (p)	0.95	0.92	0.92	0.99

[1]GE= Gross energy (Mcal/kg)

In the digestibility trial, 32 rabbits of both sexes (eight animals/ treatment) were used. The crossbreed (New Zealand White x Californian) with an average weight of 2.37 kg were distributed according to a randomised design in the four treatments. The animals were placed in individual metabolism cages and had an adaptation period to the experimental conditions of ten days and four days of faeces collection.

Meal intake and faeces quantity produced by experimental units were registered, being packed in identified plastic bags and hermetically closed, kept at -10^{o} C, to further chemical analysis. Faeces and diets were submitted to dry matter analysis (DM), crude protein (CP), mineral matter (MM) and crude fiber (CF) according to AOAC methods (1984). Phosphorus was determined by colorimetry, calcium by permanganometry and gross energy using calorimetric bomb (PARR) according to HARRIS (1970). Acid detergent fiber (ADF), neutral detergent fiber (NDF) were determined following Van Soest's recommendations (1967) and Van Soest

et al. (1991). The digestibility coefficients of nutritive principles were calculated according to SCHNEIDER & FLAT (1975).
The statistical analysis of both experiments used the Genetics and Statistical Analysis System (GSAS) developed by EUCLYDES (1982).

RESULTS AND DISCUSSION

The results of feed intake, dry matter consumption and performance are showed in Table 3. Daily weight gain (DWG) and total weight gain (TWG) were negatively affected (P<0.01), by the increase in Coast cross hay's particle size. Expressed as percentage, a decrease of about 23% was observed for DWG and TWG with increasing particle size. The figures 1 and 2 show a linear reduction of DWG and TWG according to the equations Y=35.18 – 6.6123 x and Y=1.4075 – 0.2667 x, respectively. The higher DWG and TWG were obtained with the smaller APS (0.461mm).

Table 3- Total feed intake, dry matter intake and weight gain of growing rabbits.

	Average particles size				
Variables	0.461mm	0.635mm	0.969mm	1.273mm	(CV %)
Total feed intake (g)	4,502	4,041	4,309	4,079	12.3
Total dry matter intake (g)	3,941	3,563	3,792	3,581	12.3
Daily dry matter intake (g)	98.5	89.1	94.8	89.5	13.6
Total weight gain[1] (g)	1,330	1,183	1,150	1,083	13.6
Daily weight gain[1] (g)	33.35	29.6	28.8	27.1	13.6
Feed gain ratio[2]	3.40	3.44	3.79	3.80	11.3

[1]Linear effect (P<0.01) [2]Linear effect (P<0.05)

AUVERGNE et al. (1988) submitted rabbits to diets with different particle size (1mm and 4mm) and it was observed that the finest particles increased the diet's retention time especially in the ileum. This fact can justify the higher weight gain obtained with the smaller AGD (0.461mm) because, the higher ileum retention time could provide a higher nutrient's absorption of the diet favouring a higher weight gain.
Studies had shown (LAPLACE & LEBAS, 1977, AUVERGNE et al. 1988) that the reduction of feed particle size provokes an increased cecal retention and reduces dry matter intake, what did not happen in our work, because the variables daily dry matter intake, total dry matter intake and total feed intake were not affected by APS of Coast cross hay's particles.
The feed conversion (Table 3) was affected (P<0.05) by the increase in APS of Coast cross hay. Figure 3 shows a linear increase in feed conversion according to the equations Y=3.1435 + 0.553 x, which is associated with the smaller weight gain (Figures 1 and 2).
Studies with rabbits have shown (SAKAGUCHI & HUME, 1990; GIDENNE, 1993) that the bigger particles promote a higher rate of passage of the meal, what can result in a smaller nutrients absorption, affecting feed conversion.
No significant differences were observed (P<0.05) between the digestibility coefficients (Table 4) of dry matter, crude protein, crude fiber, organic matter, neutral detergent fiber and gross energy. A linear reduction (P<0.05) was observed in acid detergent fiber digestibility with the increase of particle size, according to the equation Y=26.475 – 9.254 x as shown in figure 4.

The results allow to conclude that an APS of 0.461mm results in a better weight gain and feed conversion. Except ADF, the other digestibility coefficients were not affected by particle size.

Table 4- Apparent digestibility coefficients of experimental diets (%).

	Average particles size				
Variables	0.461mm	0.635mm	0.969mm	1.273mm	(CV %)
DM	64.6	66.0	62.2	65.0	5.4
CP	80.8	82.8	80.1	81.9	4.2
CF	18.7	21.2	14.5	20.1	37.2
OM	66.7	67.5	63.5	66.5	5.3
NDF	32.5	34.5	27.6	33.8	17.7
ADF[1]	23.2	21.3	13.5	17.1	34.2
GE	65.8	67.1	62.6	66.4	5.2

[1]Linear effect (P<0.05)

Fig. 1- Daily weight gain of rabbits related to dietary particles size

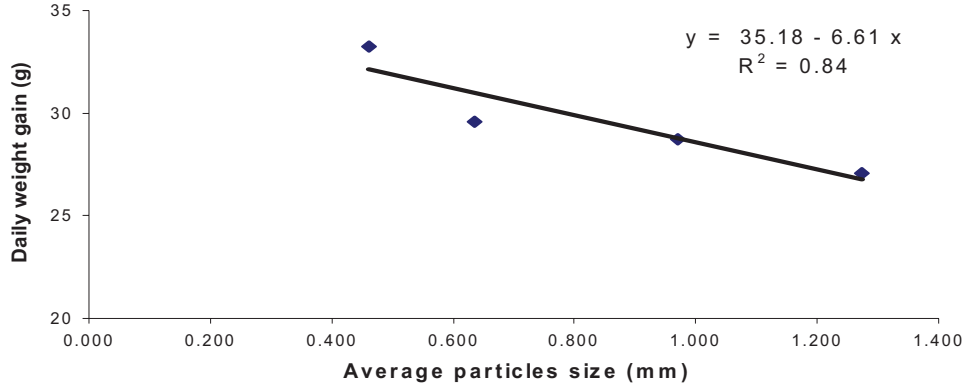


Fig. 2-Total weight gain of rabbits related to dietary particles size

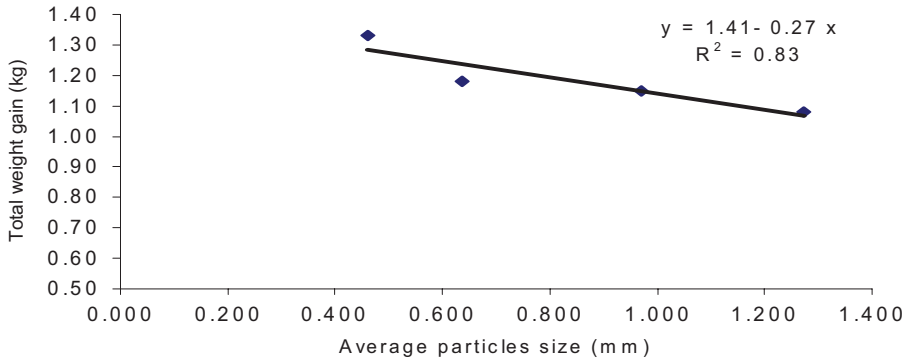


Fig.3- Feed gain ratio of rabbits related to dietary particles size

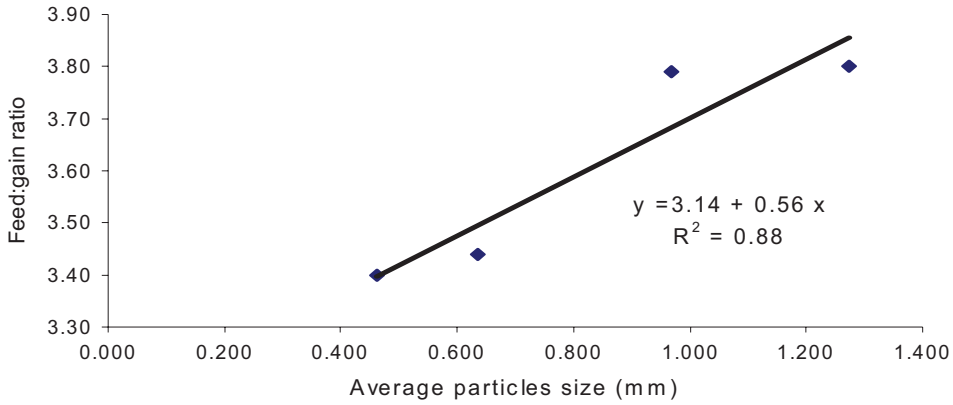
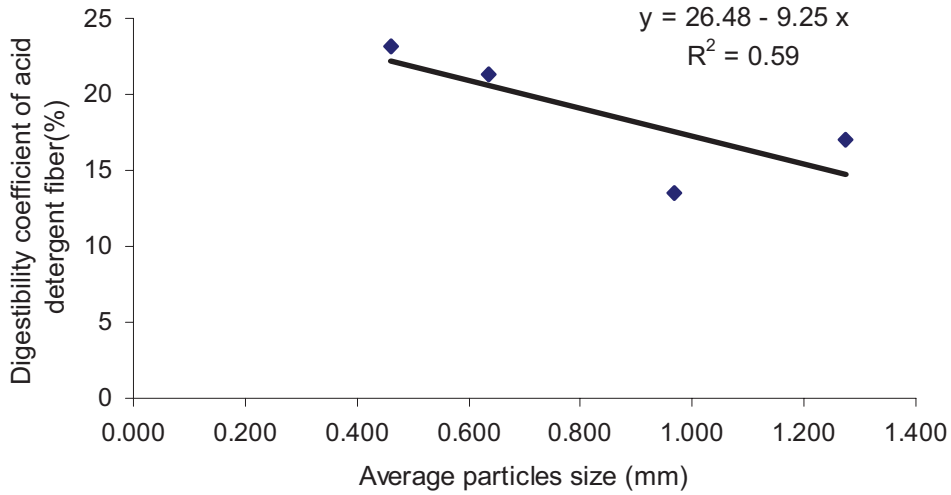


Fig.4-Apparent digestibility coefficient of acid detergent fiber related to particles size



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