USE OF CASSAVA MEAL RESIDUE ON RABBIT FEEDING

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ABSTRACT

Two assays were carried out to evaluate the digestibility of nutrients, energy and performance of growing rabbits fed on diets containing cassava meal residue (CMR), fiber variety. CMR is a residue from the cleaning of the material found on industrial premises factory in the production of cassava meal. It consists basically of cassava meal that may not be used for human consumption and of root tips from the pre-processing cleaning stage. Twenty-two 50-day-old rabbits were used in the digestibility assay, in a randomized design, with two treatments and 11 replicates. CMR substituted 25% of dry matter in control diet. Digestible dry matter, digestible protein, digestible neutral detergent fiber, digestible acid detergent fiber, digestible energy and digestible starch, of CMR, on the dry matter basis, were, respectively 85.87%, 1.43%, 2.82%, 0.91%, 3562 kcal/kg and 63.95%. One hundred and eighty rabbits, 35 day-old, were distributed in randomized blocks, with six treatments (diets), 15 replicates of two animals per experimental unit, in a performance experiment until 70 days of age. Diets consisted of isobalanced levels of protein, methionine+cystine, lysine, energy, calcium and phosphorus. CM gradually replaced corn digestible energy (0, 20, 40, 60, 80 and 100%). Results showed that CMR might be added to the diet of growing rabbits from weaning to slaughter, substituting totally the digestible energy of corn.

Key words: carcass, cassava meal, digestibility, performance, rabbits.

INTRODUCTION

Energy needs require that rabbits' diet be basically prepared from corn and cereal meals. Owing to its availability cassava and its sub-products may substitute corn, especially in tropical countries.

At the country's and at world level, cassava (*Manihot esculenta* Crantz), a highly social and economical culture, is an important source of energy both for humans and animals (BEZERRA *et al.,* 1996).

According to SEAB (2003), whereas Brazil produces some 22.5 million tons of cassava, the state of Paraná produces 60% of all cassava starch in Brazil and ranks third in the produce of cassava root, with approximately 3.6 million tons.

Cassava meal improper for human consumption is a residue from the cleaning of the material found on industrial premises floor in the production of cassava meal. It consists basically of cassava meal that may not be used for human consumption, and of root tips from the pre-processing cleaning stage.

Although no precise data are available for total residues produced, it seems that 3 to 5% of cassava root in the meal production is eliminated and residue resulting is studied (CALDAS NETO, 1999).

Actually there are few studies on the real nutrition value of cassava sub-products in animal feeding and on their possibility to substitute conventional products.

Current research aims at determining the nutrition value of cassava meal residues, by digestibility assays in rabbits, evaluating their performance, from weaning till slaughter, and the quantitative characteristics of the rabbits' carcass the animals feed on diets with increasing levels of cassava meal residues gradually substituting corn energy.

MATERIAL AND METHODS

Digestibility assay: Twenty-two White New Zealand rabbits, 50 days old, allocated individually in metabolism cages with automatic drinker, semi-automatic feeder and feces collector. Experiment followed a totally randomized design, with two treatments and 11 replicates. Was formulated a control diet based on corn (18,33%), wheat meal (19,00%), soybean meal (18,00%), alfalfa hay (23,00%), tifton 85 hay (20,00%), common salt (0,40%), dicalcium phosphate (0,10%), limestone (0,60%), DL-methione 99 (0,07%), minerals and vitamins (0,50%). The test diet consisted of 75% control diet plus 25% cassava meal residue.

Following European Reference Method for *in vivo* digestibility assay, experiment lasted 14 days, or rather, 10 days for cages and diets adaptation and four days for feces collection (PEREZ *et al.,* 1995). Analyses of Dry Matter (DM), Crude Protein (CP), Crude Energy (CE), Neutral Detergent Fiber (NDF) and Acid Detergent Fiber (ADF) were conduced, following SILVA and QUEIROZ (2002), whereas starch analysis followed enzymatic method according POORE *et al.*(1989), adapted by PEREIRA and ROSSI (1995). Coefficients of Apparent Digestibility of DM (CDaDM), Crude Protein (CDaCP), Crude Energy (CDaCE), Neutral Detergent Fiber (CDaNDF), Acid Detergent Fiber (CDaADF) and of Starch (CDaStarch) of cassava meal residue were calculated according to methodology by MATTERSON *et al.* (1965).

Performance assay: 180 White New Zealand rabbits, 90 males and 90 females, 35 days old, were distributed in a randomized block designs, with six treatments diets), 15 replicates and two animals per experimental unit (cage),one male and one female.

Treatments consisted of a control diet formulated according to growing rabbits' requirements (LEBAS, 1989) and of other five diets with increasing levels (20%, 40%,

60%, 80% and 100%) of cassava meal residue (CMR), replacing the corn digestible energy (Table 1). Rations were pelleted and given *ad libitum.*

Table 1: Ingredients and chemical compositions of diets (% as fed basis)

Ingredients	Percentage of corn replacement by CMR, based on energy					
	0 (control)	20	40	60	80	100
Cassava meal residue	-	5.28	10.56	15.83	21.11	26.39
Corn	24.08	19.26	14.45	9.63	4.82	-
Soybean meal	14.00	15.30	16.60	17.90	19.20	20.50
Wheat bran	22.00	19.82	17.64	15.46	13.28	11.10
Alfalfa hay	22.00	21.90	21.80	21.70	21.60	21.50
Tifton 85 hay	16.06	16.55	17.04	17.52	18.01	18.50
Bicalcium Phosphate	0.10	0.22	0.34	0.46	0.58	0.70
Limestone	0.65	0.56	0.47	0.39	0.30	0.21
Common salt	0.40	0.40	0.40	0.40	0.40	0.40
DL-Methionine	0.09	0.10	0.11	0.12	0.13	0.14
HCl Lysine	0.06	0.05	0.04	0.02	0.01	-
Vit+Min. Mixture[1]	0.50	0.50	0.50	0.50	0.50	0.50
Cycostat	0.06	0.06	0.06	0.06	0.06	0.06
Total	100	100	100	100	100	100
Chemical Composition						
Dry Matter	89.54	89.25	88.70	89.02	89.35	88.90
Crude Protein	16.49	16.44	16.39	16.33	16.28	16.23
NDF	29.81	29.16	28.51	27.87	27.22	26.57
ADF	17.37	17.40	17.44	17.47	17.51	17.54
Starch	21.47	21.21	20.95	20.69	20.43	20.17
Calcium	0.80	0.80	0.80	0.80	0.80	0.80
Phosphorus	0.52	0.52	0.52	0.52	0.52	0.52
MET + CIS	0.60	0.60	0.60	0.60	0.60	0.60
Lysine	0.80	0.80	0.80	0.80	0.80	0.80
Digestible Energy [2]	2554	2555	2556	2558	2559	2560

[1] Nuvital, composition per kg of product: Vit A, 600.000 UI; Vit D, 100.000 UI; Vit E, 8.000mg; Vit K3, 200mg; Vit B1, 400mg; Vit B2, 600mg; Vit B6, 200mg; Vit B12, 2.000mcg; Pantothenic acid, 2.000mg; Choline, 70.000mg; Iron, 8.000mg; Copper, 1.200mg; Cobalt, 200mg; Manganese, 8.600mg; Zinc, 12.000mg; Iodine, 64mg; Selenium, 16mg; Methionine, 120.000mg; Antioxidant, 20.000 mg.
[2] calculated on basis chemical composition (kcal/kg)

Animals were weighed at the start of the experiment, at 35 days, at 50 days, and at the end of experiment (70 days) and diet consumption were recorded at 35, 50 and 70 days of age. At 70 day old, the rabbits were killed, without fasting, and the hot carcass, without head, were weighted.

Maximum and minimum temperatures were taken daily during the experimental period. They ranged from 26ºC to 19ºC, with mean temperature at 23ºC.

In the performance experiment the statistical analysis was conduced by minimum square method (SAS, 1996) and freedom degrees for corn energy replacement levels by cassava meal residue were represented by polynomials. The control diet (level 0% of CMR) was compared against each other levels of CMR inclusion, by Dunnett's Test ($P<0.05$).

RESULTS AND DISCUSSION

Table 2 shows the chemical composition of cassava meal residue (CMR) and the digestibility coefficients of control and tests diets and CMR.

Table 2: Chemical composition of cassava meal residue (CMR) and apparent digestibility coefficients (CDa) of control diet, test diet and CMR.

Nutrients	CMR	CDa (%)		
	(% DM basis)	Control diet	Test diet	CMR
DM	89.68	58.47	68.11	95.75
CP	1.78	73.90	75.51	80.11
NDF	7.31	25.27	28.72	38.61
ADF	3.28	17.88	20.43	27.77
CE	3985 (kcal/kg)	59.19	66.99	89.38
Starch	63.95	95.70	98.48	100.00

Cassava meal residue and maize have similar chemical compositions, except at the lowest level of crude protein. According to data by CHEEKE (1995), maize grain has 88% dry matter, 9.2% crude protein, 9.9% neutral detergent fiber and 3.3% acid detergent fiber. PEREZ *et al.* (1998) record that maize has 88% dry matter, 9.2% crude protein, 10% neutral detergent fiber and 2.5% acid detergent fiber.

Studying the maize nutrition value for rabbits, SCAPINELLO *et al.* (1995) reported 87.24% apparent digestibility coefficient of dry matter and 3412kcal/kg digestible energy level. Rates above were very close to those obtained during current research with cassava meal residue.

While determining the nutritional value of maize for growing rabbits, FURLAN *et al*. (2002) reported 81.39% apparent digestibility coefficients of dry matter, 90.24% energy and 98.63% starch. These rates were also similar to those recorded in cassava meal residue. This fact shows the possibility of using this energy source for growing rabbits' diets to replace maize.

When the chemical composition and digestibility coefficients are taken into account, the digestible dry matter, digestible protein, digestible NDF, digestible ADF, digestible

energy and digestible starch for cassava meal residue, based on dry matter, amounted to 85.87%, 1.43%, 2.82%, 0.91%, 3562 kcal/kg and 63.95%, respectively.

Regression analysis showed that maize replacement by cassava meal residue decreased linearly ($p<0.05$) live weight ($LW=1289.4-0.3233x$; $R^2=0.74$), daily weight gain ($DWG=43.49-0.02702x$; $R^2=0.74$) and daily feed intake ($DFI=96,4848-0.04936x$; $R^2=0,89$) during period 35-50 days. Such difference in performance during the first growing phase, after weaning, may be due to a lesser diet intake in proportion to replacement of maize by cassava meal residue. However, when total experiment period is taken into account, or rather, 35 to 70 days, regression analysis failed to indicate any differences in performance ($p>0.05$). When Dunnet's Test was applied, only food conversion from 35 to 70 days of age in animals that received diet with 60%, 80% and 100% replacement of maize digestible energy by cassava meal residue, were better ($p<0.05$) than animals fed on control diet (Table 3).

Table 3: Live weight (LW) at 50 and 70 days old, daily weight gain (DWG), daily feed intake (DFI), food conversion (FC) of rabbits during periods 35-50 and 35-70 days of age, carcass weight (CW) and carcass yield (CY) of rabbits slaughtered at 70 days old, according to replacement levels of maize energy by cassava meal residue (CMR)

Characteristics	Diet	Replacement levels of maize energy by CMR						
	control	20%	40%	60%	80%	100%	Means	CV%
				35 - 50 days				
LW 50 d (g)[1]	1274	1284	1285	1260	1270	1254	1271	3.72
DWG (g)[2]	42.1	42.8	42.9	41.1	41.8	40.7	41.9	8.06
DFI (g)[3]	95	96	95	93	92	92	94	4.10
FC	2.28	2.25	2.23	2.27	2.22	2.27	2.25	8.14
				35 - 70 days				
LW 70 d (g)	2008	2044	2021	2069	2046	2045	2039	4.69
DWG (g)	38.9	39.9	39.3	40.7	40.1	40.0	39.8	7.07
DFI (g)	115	114	110	111	110	110	112	7.70
FC	2.96	2.85	2.80	2.73*	2.75*	2.76*	2.81	7.28
				Carcass characteristics				
CW (g)	1084	1093	1090	1116	1110	1111	1101	5.03
CY (%)[4]	53.99	53.48	53.92	53.95	54.28	54.29	53.98	2.11

* - differs from control diet by Dunnet's Test ($p<0.05$).

Regression analysis of carcass characteristics showed a linear improvement with inclusion of cassava meal ($P<0.05$) in carcass yield ($CY=53,3876+0,0099X$; $R^2=0.90$).

CONCLUSIONS

Digestible dry matter, protein, NDF, ADF, energy and starch of cassava meal residue for growing rabbits, as dry matter basis, were 85.87%, 1.43%, 2.82%, 0.91%, 3.562 kcal/kg and 63.95%, respectively.

Cassava meal residue may be added to growing rabbits' diets, replacing completely digestible energy of maize without any impairment in performance and carcass quantitative characteristics.

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