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Nutritive value of fibrous ingredients fed to pigs in the Democratic Republic of Congo measured using an *in vitro* technique

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Introduction

Incorporation of forages in the diets can improve the economics of smallholder pig production in tropical countries. However, the information on the nutritive value of fibrous crop by-products and forages species used as ingredients in pig diets is scarce. The present work aimed at measuring the chemical composition and the nutritive value using an *in vitro* model of the pig gastro-intestinal tract of 21 ingredients used by farmers in the province of Bas-Congo (D.R. Congo).

Materials and Methods

Seven grasses and 14 dicot samples were analyzed for DM, OM, crude protein, crude fat, fiber and mineral content. The samples were hydrolyzed using porcine pepsin (pH 2, 39°C, 2 h) and pancreatin (pH 6.8, 39°C, 4 h) to mimic digestion in the stomach and the small intestine. The hydrolyzed residues were subsequently fermented in an *in vitro* gas test with a pig fecal inoculum (Bindelle *et al.*, 2007) to simulate fermentation in the large intestine. Hydrolyzed ingredients were analyzed for protein in order to estimate digestible protein content. Hydrolysis of the different ingredients was compared using ANOVA, as well as the fermentation kinetics after mathematical modeling (Groot *et al.*, 1996).

Table 1 In vitro *dry matter digestibility (IVDMD), in vitro digestible protein (DP), Ca, P contents, final gas production (A) and rate of gas production of the hydrolyzed residues (Rmax)*

Ingredients	Part	IVDMD (-)	DP (g/kg)	Ca (g/kg)	P (g/kg)	A (ml/g)	Rmax (ml/g.h)
Acacia mangium	leaves	0.31	32	6.8	1.2	39	1
Amaranthus hybridus spp	plant	0.56	188	22.9	7.8	215	18
Brachiaria ruziziensis	plant	0.34	86	6.2	2.1	235	8
Cajanus cajan	leaves	0.32	34	7.4	1.6	53	2
Calopogonium muconoides	plant	0.37	144	17.4	1.8	136	12
Centrosema pubescens	plant	0.42	173	15.8	2.0	119	5
Eichornia crassipes	plant	0.31	59	10.8	1.4	92	3
Ipomea batatas	leaves	0.45	144	15.7	3.6	203	17
Leucaena leucocephala	leaves	0.37	103	24.2	1.2	85	4
Manihot esculenta	leaves	0.43	176	20.7	4.1	169	15
Moringa oleifera	leaves	0.43	179	28.3	3.3	168	13
Mucuna pruriens	plant	0.46	187	26.3	2.0	155	9
Panicum maximun wild cultivar	plant	0.29	101	7.4	2.8	170	5
Panicum maximun var. T58	plant	0.25	77	7.4	3.2	196	6
Pennisetum purpureum	plant	0.30	68	3.6	1.5	207	7
Psophocarpus scandens	plant	0.49	247	14.5	3.4	155	8
Pueraria javanica	plant	0.38	156	10.5	2.7	122	8
Saccharum offinarum	leaves	0.42	30	4.6	0.9	88	3
Stylosanthes guianensis	plant	0.25	101	21.9	4.8	173	11
Trypsacum laxum	plant	0.27	60	4.0	2.0	183	5
Vigna unguiculata	plant	0.48	221	37.0	3.4	183	12
P-value		<0.001	N/A	N/A	N/A	<0.001	<0.001

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Results and discussion

The results from chemical analyses and *in vitro* digestibility summarized in Table 1 show as expected a generally lower nutritive value of grasses compared to dicots and especially legume species. With poor enzymatic digestibility and fermentability, *A. mangium* leaves must be advised against for use by farmers. Crop residues of *A. hybridus*, *I. batatas*, *M. esculenta*, *P. scandens* and *V. unguiculata* and herbaceous and woody forage species such as *M. pruriens* and *M. oleifera*, respectively, look promising. They combine high digestible energy, assessed through IVDMD, A and Rmax, high DP contents with high levels of minerals. Nevertheless, future work should assess the maximum levels of incorporation in diets as most of these ingredients contain anti-nutritional components reducing voluntary intake, digestibility or both.

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Digestibility, metabolic utilization and nutritional value of *Cassia tora* (Linn.) leaf meal incorporated in indigenous Senegal chickens diets

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Introduction

Indigenous chicken production is confronted with various constraints in which feed is a major challenge. Besides the lack of dietary supplement, village chickens face quantitative and qualitative feed shortages particularly in a poor agricultural or household residue environment. Moreover, because of the increasingly cost of common protein ingredients (groundnut cake, soybean or fish meal) traditional stockholders often have little access to such resources. However, studies carried out on legumes reported that the leaves of *Cassia tora*, are rich in protein, essential amino acids and minerals. The prospect thus arises of using *Cassia tora* leaf meal as a protein ingredient source in Senegal indigenous chickens diets. This study was undertaken to determine their nutrient utilization and nutritional value.

Materials and methods

Cassia tora leaves were collected mainly in the region of Thies, 70 km from Dakar. They were dried for 1–2 days and processed into meal using a grinder mesh 4 mm in diameter. The leaf meal and the other common ingredients (yellow maize, white sorghum, millet, wheat bran, fish meal, and groundnut cake) were analysed for their composition using AFNOR technical. These ingredients were used to formulate four iso-nutrient calculated dietary treatments (CT_0, CT_5, CT_{10} and CT_{15}) containing respectively 0, 5, 10 and 15% of *cassia tora* leaf meal. Experiments were undertaken from 15th to 27th, November 2009. Twenty adult indigenous chickens with an average weight of 1.16 kg were raised in metabolic cages and allocated into four dietary treatments groups of five birds each. During the experiment feed offered and fresh excreta collected were weighted daily for six days. The droppings were oven-dried at 60°C and ground for nutrient analysis per bird. Daily feed intake (DFI) and average daily weight gain (ADWG) were calculated. Apparent coefficients of nutrient utilization (ACNU) were determined according to the following formula: $ACNU = (NI - NF) \div NI$, where NI was nutrient intake and NF nutrient excreted. Data were analysed at 5% level by variance analysis (ANOVA) completed with t-test when ANOVA showed significant difference.

Results

The *Cassia tora* leaf meal was relatively rich in protein (27.44% DM), crude fiber (16.8% DM), NDF (25.7% DM) and ash (15.16% DM), particularly calcium (3.13%) and potassium (1.3% DM). It contained respectively 3.82% DM, 36.77% DM and 2050.47 kcal/kg DM of ether

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