STUDIES ON RECTAL DIGESTIBILITY AND PERFORMANCE TRAITS OF YOUNG CAMBODIAN KHONDOL PIGS

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SUMMARY

An evaluation was made on the influence of genotype, Cambodian Khondol and Duroc, on performance traits and rectal digestibility indices of eight 10 kg castrate male young pigs fed ad libitum a common, local diet based on wheat bran and fresh water dry fish (Nx6.25, 18% in dry basis).

There were no genotype effect (P>0.05) on performance traits of animals, as measured in the current investigation. Overall, a low voluntary feed intake was found (below 1 kg DM/day), and it would be probably due to the hot and wet environment where the pigs were kept (average air temperature at midday was 36^{o}C). There were no breed effect (P>0.05) on digestibility of DM (76.9 and 74.8%), organic matter (83.4 and 83.2%) and N (75.8 and 76.6%) for Khondol and Duroc animals respectively. Faecal DM digestibility was correlated (R^2, 0.783; P<0.01) to faecal organic matter digestibility. Faecal output of fresh material was consistently high, with no treatment effect (1 073 and 1 067 g per kg DM intake). Crude fibre and NDF digestibility appeared to be different (P<0.10) between the two evaluated genotypes, favouring the Khondol type.

It is suggested that the relatively low digestibility indices found in the current investigation was due to the high cell wall fraction in the diet and the low live weight of the animals. More experiments should be carried out with older animals in order to evaluate the possible adaptation of gastrointestinal microflora in pigs exhibiting a higher retention time of digesta in the large intestine. Since digestive processes are highly linked to feed intake and other performance traits, these relationships should be useful to establish in local pigs raised in the tropical environment.

Key words: *pigs, Khondol, genotype, faecal output, digestibility, fibre*

Short title: *Digestibility and performance traits in Khondol pigs*

ESTUDIOS SOBRE LA DIGESTIBILIDAD RECTAL Y RASGOS DE COMPORTAMIENTO EN CERDOS JOVENES CAMBOYANOS KHONDOL

RESUMEN

Se hizo una evaluación de la influencia del genotipo, Khondol camboyanos y Duroc, en los rasgos de comportamiento e índices de digestibilidad rectal de ocho cerdos jóvenes machos castrados alimentados ad libitum con una dieta local común de afrecho de trigo y pescado seco de agua dulce (Nx6.25, 18% in base seca).

NO hubo efecto de genotipo (P>0.05) en los rasgos de comportamiento de los animales, tal como se midieron en esta investigación. En general, se halló un bajo nivel de consumo voluntario (menos de 1 kg MS/día), y esto probablemente sería por el ambiente de alta temperatura y humedad (temperatura promedio del aire al mediodía, 36^{o}C) en el que se mantuvo a los cerdos. No hubo efecto de raza (P>0.05) en la digestibilidad de la MS (76.9 y 74.8%), materia orgánica (83.4 y 83.2%) y N (75.8 y 76-6%) para los animales Khondol y Duroc, respectivamente. La digestibilidad fecal de MS estuvo correlacionada (R^2, 0.783; P<0.01) con la digestibilidad fecal de la material orgánica. La salida fecal de material fresco fue consistentemente alta, sin efecto de tratamiento (1 073 y 1 067 g por kg de MS ingerida).La digestibilidad de la fibra cruda y de la FDN parecieron ser diferentes (P<0.10) en los genotipos evaluados, a favor de los cerdos Khondol.

Se sugiere que los índices de digestibilidad relativamente bajos que se hallaron en esta investigación fueron bajos debido a la alta fracción de pared celular vegetal presente en la dieta, y al bajo peso vivo de los animales. Debieran conducirse más experimentos con animales más viejos para evaluar la posible adaptación de la microflora del tracto gastrointestinal en cerdos que tengan una tiempo mayor de retención de digesta en el intestino grueso. Puesto que los procesos digestivos están altamente ligados al consumo de alimento y a otros rasgos de comportamiento, sería útil establecer estas relaciones en cerdos locales criados en ambiente tropical.

Palabras claves: *cerdos, Khondol, genotipo, salida fecal, fibra*

Título corto: *Digestibilidad y rasgos de comportamiento en cerdos Khondol*

INTRODUCTION

It is very common to find out throughout Cambodia many farmers rearing small herds of pigs, which in turn are raised by the aid of fibrous feedstuffs, such as wheat bran, rice bran and water spinach (Ly 2005). These materials, which are considered to be not very well digested by the pig (Fernández and Jorgensen 1986; Bach Knudsen and Jorgensen 2001; Wenk 2001), are on the contrary very cheap and locally available elsewhere in that country.

On the other hand, as compared to other local breeds from Indochina (Wünsche et al 1994; Borin et al 2005; Vasupen et al 2007), there is no previous information concerning digestibility of diets in Khondol pigs (Ly 2005). This genotype is considered native of Cambodia, and it is characterized by its low size and its black coat. Khondol pigs are commonly found in remote areas of this country, mainly in the peripheral provinces of Cambodia, with particular emphasis in the North East part, very hilly and covered of forest.

The aim of this report is to describe some digestive characteristics of Khondol young pigs fed a common, locally available type of diet, very rich in cell wall content.

MATERIALS AND METHODS

The experiment was conducted during the rainy season of Cambodia, during August and September, and the average air temperature at midday was 36^{o}C

A diet mainly consisting on wheat bran and fresh water dry fish was used in this investigation, and the composition of the diet as well as its chemical characteristics is presented in table 1. Wheat bran and fish were obtained at a local market of Phnom Penh City, in places where it is common to find merchandise offered to feed animals. The vitamin and mineral premix was of commercial origin. The diet was formulated to contain approximately 18% crude protein (Nx6.25), and besides its simple formulation, its main outstanding characteristic was its high cell wall content, 47.5%.

Table 1. Ingredients and chemical composition of the experimental diet

	Value, % DM
Ingredients	
Wheat bran	69.9
Maize bran	19.9
Fresh water dry fish	10.1
Vitamins and minerals[1]	0.1
Analysis	
Dry matter	87.51
Ash	9.13
Acid insoluble ash	1.27
Organic matter	90.87
Crude fibre	9.25
NDF	47.50
N	2.90
WHC, g H_2O/g DM[2]	4.63

[1] According to NRC (1998) requirements
[2] For details, see text

The experiment was conducted with a total of eight Duroc and Khondol castrate male pigs of approximately 10 kg on average to study faecal characteristics of these animals when fed a diet very rich in fibre fractions. Khondol and Duroc animals were from herds kept by farmers outside Phnom Penh. The animals were weighed at the beginning of the trial, then every week during one month, in order to assess performance traits of the pigs.

Every animal was housed in individual pens located in an open room. Every pen had individual a feeding trough and drinker. The diets were offered ad libitum to the pigs as a meal served at 8:00 am every morning after feed refusals per animal were collected and recorded. A grab sampling of faeces was conducted on day 28 of experimentation. Then rectal excretion was stimulated by direct massage. Faeces collection was made before weighing the animals at 7:00 am. Immediately after the collection of faeces, the samples were thoroughly mixed and the pH value was established by the aid of a glass electrode attached to a pHmeter device.

Samples of food and faeces were analyzed for DM by microwave radiation (Undersander et al |933), whereas ash, crude fibre and N according to the Association of Official Analytical Chemists (AOAC 1990). The organic matter concentration in the samples was considered to be the resuot of substration of the percent of ash from 100. In the case of NDF, the methodology of Van Soest et al (1991) was employed. The filtration alternative of Tsaras et al (1998) as undertaken by Ly et al (2003) was choose for the measurement of water holding capacity (WHC) of the samples. Feed and faeces were subjected to acid insoluble ash analysis following the procedure of Van Keulen and Young (1977) using HCl 2 N as acid solution for digestion of feed and faeces ashes.

Faecal output in pigs, either in fresh basis or water, expressed in g, were calculated by adjusting to one kg DM intake, according to the formulae:

Fresh material = (undigested faecal DM, g/faecal DM, %) x 100

Water output = Fresh material – dry material

On the other hand, undigested faecal DM, expressed in g, was estimated by the equation:

Undigested faecal DM = 100 – DM digestibility, %

Rectal digestibility indices determined by the indirect method, were calculated following Schneider and Flatt (1975). Acid insoluble ash was used as inner marker for calculation purposes. Analyses of variance and correlation were conducted according to a standard technique (Steel et al 1997). The Minitab software (Ryan et al 1992) was used in the biometrical manipulation of data.

RESULTS AND DISCUSSION

Performance traits

There were no genotype effect (P>0.05) on performance traits of animals, as measured in the current investigation (table 2).

Non significant effects as found in the conducted analysis of variance, would be the consequence of the small population size herein examined. Overall, a low voluntary feed intake was found, and it would be probably due to, on one hand, to the bulky nature of the diet, and on the other hand, to the hot and wet environment where the pigs were kept. It is well known that above the comfort temperature, about 22^{o}C, feed intake of pigs and other performance traits are concomitantly deteriorated (Gourdine et al 2005). In the case of the feed given to the Khondol pigs in the current evaluation, it is probable that its bulky characteristics could influence the voluntary feed intake , as it has been suggested by Tsaras et al (1998). Interestingly, Chanphone (2003) encountered a low voluntary feed intake in Laosian pigs too.

Table 2. Performance traits of pigs fed wheat bran. Effect of genotype

	Genotype		
	Duroc	**Khondol**	**SE ±**
n	4	4	-
DM intake, kg/day	0.99	0.92	0.10
Daily gain, kg	0.39	0.29	0.14
Feed conversion, kg DM/kg	2.58	3.16	0.88

Khondol pigs appeared to exhibit a lower daily gain and a higher feed conversion, as compared to the Duroc animals. Chanphone (2003) found that local Laosian, 10-40 kg liveweight pigs, which are very similar to the Khondol genotype, had a slower rate of daily gain, between 154 and 320 g. In this connection, it has been claimed that one of the outstanding characteristics of improved pig breeds is based on its efficiency of feed utilization, perhaps due to its better body composition (Yen et al 1981; Rinaldo et al 2003). This assumption would remain to be supported by research conducted in this direction, from the point of view of Khondol pigs.

Rectal digestibility

The effect of genotype on faeces characteristics and rectal digestibility are in table 3. There were no significant (P>0.05) of genotype in any measurement determined in the faecal samples of pigs, although faecal output of fresh material and water appeared to be slightly greater in Khondol pigs, in contrast to what occurred in Duroc animals. The contrary was true for faecal dry material output.

There were no breed effect (P>0.05) on digestibility of DM (76.9 and 74.8%), organic matter (83.4 and 83.2%) and N (75.8 and 76.6%) for Khondol and Duroc animals respectively (tabla 3). On the other hand, crude fibre and NDF digestibility appeared to be different (P<0.10) between the two evaluated genotypes. These data are in accordance with previous results found in other reports from Indochina revealing that local pigs are better equipped for digestion of fibre than other exotic animals (Ly et al 2003; Borin et al 2005). To what extent it should occur in the older Khondol pig remains to be examined.

It could be considered that the low rectal digestibility of DM which was found either in Duroc or Khondol pigs was a direct consequence of the high cell wall content of the diet, since it is well known that fibrous materials determine a decrease in nutrient utilization by the pigs (Fernández and Jorgensen 1986; Bach Knudsen and Hansen 1991; Bach Knudsen and Jorgensen 2001; Wenk 2001). It is possible that as the animals should be aged, a better fit of intestinal bacteria to the attack the fibrous structure of the feeds, as it has been suggested (Varel et al 1984; Varel 1987) should take place.

Table 3. Rectal digestibility indices of pigs fed wheat bran. Effect of genotype

	Genotype		
	Duroc	**Khondol**	**SE ±**
n	4	4	-
Faecal characteristics			
pH	7.23	7.30	0.36
DM, %	23.54	21.43	1.35
Faecal output, g/kg DM intake			
Fresh material	1 067	1 073	160
Water	815	842	126
DM	252	231	38
Digestibility, %			
Dry matter	74.85	76.93	3.83
Organic matter	83.24	83.40	0.24
Crude fibre	30.10	37.23	3.05^{+}
NDF	40.40	45.15	2.00^{+}
N	76.68	75.88	2.04

$^{+}$ P<0.10

Faecal DM digestibility was correlated ($R^{2,}$ 0.783; P<0.01) to faecal organic matter digestibility (figure 1). A similar relationship was observed in Mong Cai pigs by Ly and Pok Samkol (2008).

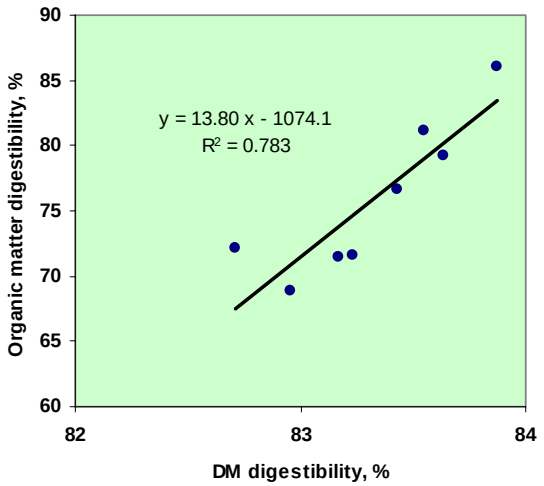

Figure 1. Interdependence between faecal DM and organic matter digestibility in Khondol pigs

It is suggested that the relatively low digestibility indices found in the current investigation was due to the high cell wall fraction in the diet and the low live weight of the animals. More experiments should be carried out with older animals in order to evaluate the possible adaptation of gastrointestinal microflora in pigs exhibiting a higher retention time of digesta in

the large intestine. Since digestive processes are highly linked to feed intake and other performance traits (Siers 1975), these relationships should be useful to establish in local pigs raised in the tropical environment.

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