

## Effect of body weight and sex on rectal digestibility of nutrients and feces output in Mexican Cuino pigs

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### ABSTRACT

A 2 x 2 factorial arrangement was used to determine the effect of sex (castrate males and female individuals) and body weight (32 and 47 kg) on rectal nutrient digestibility and feces output of 14 Mexican Cuino pigs fed *ad libitum*. A conventional diet was offered in meal form with an initial live weight of 20,1 kg. Contrary to what occurred for fecal N status, there was a significant ( $P < 0,05$ ) body weight x sex interaction for DM and organic matter rectal digestibility and for fresh, dry and water feces output. It was found that there was not significant ( $P > 0,05$ ) sex influence on DM, organic matter and N rectal digestibility of animals. There was not body weight effect on N digestibility. Feces output was not influenced by sex ( $P > 0,05$ ), but 32 kg pigs excreted significantly ( $P < 0,01$ ) more fresh material and water as well as N compounds and DM ( $P < 0,001$ ), than 47 kg animals. It is concluded that rectal digestibility of a conventional diet given *ad libitum* in meal form is high in the Mexican Cuino pigs.

*Keywords:* body weight, sex, nutrient digestibility, feces output, Mexican Cuino pig.

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### Efecto de peso corporal y sexo en la digestibilidad rectal de nutrientes y salida fecal en cerdos Cuino mexicanos

#### RESUMEN

Se usó un arreglo factorial 2 x 2 para determinar el efecto del sexo (machos castrados y hembras) y el peso corporal (32 y 47 kg) en la digestibilidad rectal y la salida fecal de 14 cerdos Cuino mexicanos alimentados *ad libitum* desde los 20,1 kg con una dieta convencional ofrecida en forma de harina. Contrariamente a lo encontrado en el N fecal, hubo efecto significativo ( $P < 0,05$ ) en la interacción peso corporal x sexo para la digestibilidad de MS y materia orgánica, y en la salida fecal de material fresco, seco y agua. No se encontró influencia significativa ( $P > 0,05$ ) del sexo en la digestibilidad rectal de MS, materia orgánica y N de los animales. No hubo efecto de peso corporal en la digestibilidad del N. La salida fecal de materiales no fue influida por el sexo ( $P > 0,05$ ), pero los cerdos de 32 kg excretaron significativamente ( $P < 0,01$ ) más materiales fresco y agua, así como compuestos de N y MS ( $P < 0,001$ ), que los animales con 47 kg. Se concluye que la digestibilidad rectal de una dieta convencional dada *ad libitum* en forma de harina es alta en cerdos Cuino mexicanos.

*Palabras clave:* peso corporal, sexo, digestibilidad de nutrientes, salida fecal, cerdos Cuino mexicanos.

## INTRODUCTION

Although several factors have been investigated as influencing digestive indices in pigs, for example, sex and body weight (Everts *et al.*, 1986; Noblet *et al.*, 1993), very few is known about the effect of sex and body weight on nutrient digestibility, concerning local pigs (Ly, 2008a), Mexican Cuino pigs included. In this regard, Mexican Cuino pigs are a local type of breed which is of small size. The animals are currently hirsute in nature, showing very often a curly type of hair, whereas the skin is commonly black.

The animals are very docile and this type of pigs attains adult body weight at approximately 50 kg (Grageola and Lemus, 2007). Cuino pigs are animals considered very well adapted to environmental conditions, due to its ability for being raised either in a natural environment where feed resources are commonly available (Lemus and Alonso-Spilbury, 2005). Knowledge concerning the nutritional status and digestive ability of Cuino pigs for growth is lacking (Ly, 2008a).

Perhaps one of the main differences characterizing pig production of improved or local pigs is that the exotic animals are commonly raised in big farms (Nyachoti *et al.*, 2006; Aarnink and Verstegen, 2007), whereas local pigs are usually breed in a backyard, subsistence status.

In this context, it could be thought that feces in pig farms are a main challenge due to environmental pollution. In contrast, feces originated from local pigs in a rural milieu are directed to be incorporated into soil in a natural manner. Therefore, basic information for designing proper strategies to reduce environmental contamination is essential in any program for local pig improvement (Kerr, 2003).

The objective of the present communication is to report an experiment conducted with the aim to determine the effect of body weight and sex on nutrient digestibility and feces output in Mexican Cuino pigs.

## MATERIALS AND METHODS

A total of 14 Mexican Cuino pigs, seven castrate males and seven female individuals, were used for determining rectal digestibility of nutrients and feces output. The pigs were from Nayarit state, where they are commonly raised in the rural milieu

of this Mexican state by paysans. The pigs had on average 20,1 kg at the commencement of the trial and were housed individually in cement floored pens located in a closed building, at the Academic Unit of Agriculture, Xalisco. All pens were provided of a through and drinking nipple. These animals were used in a growth trial (Lemus *et al.*, 2009) to determine performance traits of economic interest. Pigs were fed *ad libitum* with a 14% crude protein (N x 6,25) diet. Table 1 lists ingredient and nutrient characteristics of the experimental diet.

The pigs were weighed every four weeks during a 16 week-period. Average body weight of pigs was 32 and 47 kg in the second and third weighing schedule. Feces from all animals were obtained by digital stimulation of rectum, in the moment of weighing the pigs. Samples of feces were conveniently identified and stored at -20°C until analysis. Feces were thawed and DM, ash and N content were determined in fresh aliquots of the samples according to procedures described by A.O.A.C. (1995). Organic matter was considered to be the result of ash content subtraction from 100. Acid insoluble ash was assayed in the ashed samples, according to the Van Keulen and Young (1977) technique. The same routine was applied to the used feedstuff. All analyses were conducted by duplicate.

Apparent rectal nutrient digestibility was calculated as outlined elsewhere (Ly, 2008b). Data were analyzed by a standard analysis of variance (Steel and Torrie, 1980), conducted through the SAS (2002) software by applying a general lineal model procedure, a 2 x 2 factorial arrangement was used taking into account the effects of body weight, sex, and the interaction body weight x sex. For the differences of averages in all the effects was used Tukey's studentized range test.

## RESULTS AND DISCUSSION

### General

The animals appeared to be in good health and they were in positive live weight balance during the trial. On the other hand, there was no feed refusal in any case. Fecal DM, organic matter and N content were not significantly ( $P > 0,05$ ) influenced by body weight x sex interaction. Table 2 lists fecal characteristics of the evaluated Cuino pigs.

Table 1. Characteristics of the experimental diet.

	Per cent in dry basis
<b>Ingredients</b>	
Maize meal	79,52
Soybean meal	17,51
NaCl	0,50
CaPO <sub>4</sub> H.2H <sub>2</sub> O	1,30
CaCO <sub>3</sub>	0,67
Premix <sup>1</sup>	0,50
<b>Analysis</b>	
Dry matter	94,14
Ash	6,82
Organic matter	93,18
Crude fibre	3,04
Crude protein (N x 6,25)	14,24

<sup>1</sup> Vitamins and trace elements following NRC (1998) requirements.

Table 2. Fecal characteristics of Mexican Cuino pigs (in percent, dry basis).

	Dry matter	Organic matter	N
<b>Effect of sex</b>			
Castrate males	31,02	77,86	3,33
Females	31,28	77,64	3,30
SE ±	1,02	1,42	0,20
<b>Effect of body weight</b>			
32 kg	31,87	75,77	3,66
47 kg	30,44	79,74	2,97
SE ±	1,00	0,95	0,15***

\*\*\* P < 0,001.

There was not significant ( $P > 0,05$ ) differences for DM and organic matter concentration from the point of view of the main effects considered in the current investigation, but the contrary held true for fecal N level, which were significantly ( $P < 0,001$ ) when the effect of body weight was evaluated.

#### Fecal dry and organic matter status in Cuino pigs

There was a significant ( $P < 0,05$ ) body weight x sex interaction influence for DM and organic matter rectal digestibility (Table 3). The same significant ( $P < 0,05$ ) interaction effect was observed

for either fresh or dry and water feces output. The explanation for these findings is not apparent. In fact, this encountered significant effect was due to the low variability observed in the measured digestion criteria. As illustration, DM and organic matter digestibility showed a coefficient of variability as low as 0,77 and 1,32% respectively. In this connection, in the knowledge of the authors, there are no previous reports concerning any significant interaction neither for body weight x sex, nor for age x sex when these variables have been examined before (Wenk and Morel, 1985). These finding merit more investigations to be done.

Table 3. Rectal characteristics in Mexican Cuino pigs. Effect of sex and body weight.

	Body weight, 32 kg		Body weight, 47 kg		SE $\pm$
	Castrate male	Female	Castrate male	Female	
Rectal digestibility, %					
Dry matter	81,1c	84,0bc	88,0a	86,1ab	0,66*
Organic matter	77,2b	80,4b	90,0a	88,3a	1,11*
Fecal output, g/kg DM intake					
Fresh material	489ab	620a	464b	383b	23,9*
Water	330ab	431a	325ab	264b	18,1*
Dry material	159a	188a	138b	119b	6,6*

\* P <0,05.

abc Means without letters in common in the same row differ significantly according to the Tukey test.

It was found that the effect of sex was of little influence ( $P >0,05$ ) on rectal digestibility of DM and organic matter (Table 3). In accordance with the present investigation, Wenk and Morel (1985) did not observe changes of importance between improved castrate male and female pigs when rectal digestibility of energy was evaluated. However, earlier studies carried out by Holmes *et al.* (1980), suggested that there was a sex effect on rectal digestibility of energy and nitrogen. Furthermore, Noblet *et al.* (1993) reported that there was a sex effect on rectal digestibility in Large White pigs, where female animals had a slight advantage for rectal energy digestibility as compared to either entire or castrate male individuals.

Dry matter and organic matter rectal digestibility significantly ( $P <0,001$ ) increased with higher body weight of Cuino pigs. These data are in accordance with what it has been generally found, since a slight, but evident increase in rectal digestibility of either energy or organic matter was evident as long as improved pigs were aging, from growing pigs to sows (Cunningham *et al.*, 1962; Fernández *et al.*, 1986; Jentsch *et al.*, 1989; Noblet *et al.*, 1993; Le Goff and Noblet, 2001; Morel *et al.*, 2006).

Table 4 lists feces output indices of pigs as affected by sex. It was not encountered any significant ( $P >0,05$ ) influence of sex neither on feces output and fresh and dry material, nor on N compound fecal excretion. In this connection, Ly (2008c) did not find any effect

of sex on feces output of materials corresponding to improved pigs.

It was observed that younger, 32 kg pigs, excreted more materials in feces than 47 kg animals (Table 2). This phenomenon was highly significant ( $P <0,001$ ) for DM, as compared to fresh material and water ( $P <0,01$ ). The observations herein reported are in agreement with an increase in rectal DM digestibility in heavier Cuino pigs.

#### Fecal N status in Cuino pigs

Contrary to what it was found for DM and organic matter status, there was not significant ( $P >0,05$ ) body weight x sex interaction from the point of view of N rectal digestibility and fecal output in Cuino pigs, and data from these main effects are listed in Table 4. On the other hand, there was not influence of sex on N digestibility at the rectal site of measurement, although female pigs appeared to have a high N digestibility if compared to the castrate male individuals, in agreement with other results (Noblet *et al.*, 1993). In this connection, Noblet *et al.* (1993), considered that their results could be linked to a lower feed intake of female than in male pigs. Another factor which might be involved in the above mentioned results could be related to certain anorexia, and therefore, a decrease in voluntary feed intake as determined by estrus in Cuino female pigs, which belongs to a precocious type of local breed (Lemus and Alonso-Spilbury, 2005).

Table 4. Rectal N digestibility and fecal N output in Mexican Cuino pigs. Effect of sex and body weight<sup>1</sup>.

	Rectal digestibility, %	Fecal output, g/kg DM intake
Effect of sex		
Castrate males	77,1	5,3
Females	78,1	5,0
SE ±	1,98	0,61
Effect of body weight		
32 kg	76,5	6,4
47 kg	78,2	3,9
SE ±	1,23	0,50***

<sup>1</sup>The interaction body weight x sex was not significant (P < 0,05).

\*\*\* P < 0,001.

Estrus signals in female individuals were not recorded in the current investigation. In contrast to what it was encountered for DM and organic matter rectal digestibility, the herein listed data suggested that digestive utilization of N in the Cuino pigs was not affected by body weight between 32 and 47 kg. In this regard, Holmes *et al.* (1980) did not find a clear body weight effect on N digestibility when either Duroc or Large White pig digestibility was examined between 30 and 80 kg. In this connection, Roth and Kirchgessner (1984) observed that there were not marked differences in rectal digestibility of DM and N in pigs fed with conventional diets between 8 and 80 kg. The same findings were obtained by Everts *et al.* (1986).

It was found that fecal N output was considerably influenced (P < 0,001) by body weight. In support to the current evaluation, Nyachoti *et al.* (2006) reported equivalent fecal N output characteristics in improved very young pigs. However, data of fresh and dry material output appeared to be lower in animals used by Nyachoti *et al.* (2006) if compared to that of the figures reported herein, which in turn approached to values found by Pierce *et al.* (2006). Dietary factors influencing feces and urine output of N have been studied by Canh *et al.* (1998). Other contaminant materials have been evaluated by Dourmad and Jondreville (2007). It is not known if the nature of the diet, the breed of animals or both, could be implied in the amount of fecal output of Cuino pigs. Undoubtedly, more research is needed in this direction.

## CONCLUSIONS

According to the results herein presented, it is concluded that rectal digestibility of a conventional diet given *ad libitum* in meal form is high in the Mexican Cuino pig. On the other hand, the body weight x sex interaction appears to exist during growth of Cuino pigs from the point of view of rectal digestibility and excretion of materials at the rectum site. Further research is necessary to determine whether pigs with distinct genotypes, including those of local animals, such as the Mexican Cuino pig, would respond to several factors other than sex and body weight, influencing digestion of nutrients and fecal output of materials.

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