

A NOTE ON IN VITRO (PEPSIN/PANCREATIN) DIGESTION OF PUMPKIN (*Curcubita maxima*) PRODUCTS IN PIGS

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SUMMARY

*An experiment was conducted to study in vitro (pepsin/pancreatin) digestion of pumpkin (*Curcubita maxima*) products, entire seedless fruit and seed meals, as potential feedstuffs for pigs.*

It was found that ash content in pumpkin seeds was near one third ($P<0.01$) to that found in seedless pumpkins, and therefore, the reverse was true for organic matter ($P<0.05$). In the case of crude fibre, ether extract and crude protein (Nx6.25) values, the seeds were higher ($P<0.01$) in content of these fractions as compared to seedless pumpkins. In vitro digestibility of organic matter and N revealed to be 81.1 and 70.0% for seedless pumpkins and 77.7 and 85.4% for pumpkin seeds, respectively.

According to the results presented herein, it could be of interest to find out methods to increase the feeding value of pumpkin products for feeding pigs, due to the high nutritive value of either seedless pumpkins or pumpkin seeds.

Key words: pigs, digestion, in vitro digestibility, pumpkin, seeds

Short title: In vitro digestion of pumpkin products in pigs

UNA NOTA SOBRE LA DIGESTION IN VITRO (PEPSINA/PANCREATINA) DE PRODUCTOS DE CALABAZA EN CERDOS

RESUMEN

*Se llevó a cabo un experimento para estudiar la digestión in vitro (pepsina/pancreatina) de harina de productos de calabaza o auyama (*Curcubita maxima*), entera sin semillas y las semillas, como alimentos potenciales para cerdos.*

Se halló que el contenido de cenizas en las semillas de calabaza fue cerca de un tercio ($P<0.01$) del valor hallado para las calabazas sin semillas, y por lo tanto lo contrario fue cierto para la materia orgánica ($P<0.05$). En el caso de los valores de fibra cruda, extracto etéreo y proteína bruta (Nx6.25), las semillas contuvieron más ($P<0.01$) de los mismos en comparación con los frutos sin semillas. La digestibilidad in vitro de la materia orgánica y el N fue 81.1 y 70.0% para los frutos sin semilla y 77.7 y 85.4% para las semillas.

De acuerdo con los resultados aquí presentados, sería de interés el hallar métodos que incrementaran el valor como alimento de los productos de calabaza para dar a los cerdos, debido al alto valor nutritivo tanto de las frutas sin semillas como de las semillas en sí.

Palabras claves: cerdos, digestión, digestibilidad ileal, digestibilidad in vitro, calabaza, semillas

Título corto: Digestión in vitro de productos de calabaza en cerdos

INTRODUCTION

In several occasions, the use of common pumpkins and squashes (*Curcubita maxima*) and other fruits from plants of the same botanical family, and some of its products, has been evaluated as a potential feedstuff for pigs in the tropics (Zucker et al 1958; Bressani and Arroyave 1963; Manjarrez et al 1976; Murillo 1984; Corzo et al 2004). In this connection, pumpkins (*Curcubita spp*) could be good candidates for being considered in small pig production in tropical countries, even in fresh state, due to the fact that these fruits are harvested from a short-

cycle crop, demanding low agronomic requirements. Moreover, the crop does have high yields of pumpkins, than in turn, can be stored for a prolonged period of time (Rodríguez and Mendoza 1966). On the other hand, pumpkins appears not to contain harmful levels of antinutritional factors (Douglas and Dahir 1987; Zdunczyk et al 1999). Nevertheless, its high water content could be a serious obstacle for feeding pigs with high levels of fresh pumpkins in the diet, due to a decrease in the voluntary feed intake (Barrios et al 2004).

It has been proposed that the in vitro, pepsin/pancreatin digestibility technique is a rapid and valuable method for discrimination of the nutritive value of different products showing a potential as feedstuffs for pigs (Dierick et al 1985). This idea is reinforced when this type of products are locally available, and in some instances, are considerable as waste products with not value from the point of view of nutrition of animals. Indeed, the search for these types of products can greatly contribute to sustainability in many tropical countries (Ly 1993). The in vitro (pepsin/pancreatin) technique has been employed for evaluation of other tropical feedstuffs for pigs (Ly et al 1999; Ly and Delgado 2005a,b).

The aim of the present experiment was to provide information of the nutritive value of some pumpkin products for pigs, from the point of view of the in vitro digestibility technique.

MATERIALS AND METHODS

An experiment was designed for examination of in vitro (pepsin/pancreatin) digestion of pumpkin (*Curcubita maxima*) products, which consisted of entire seedless fruit and seed meals, as potential feedstuffs for pigs.

Four representative samples of either ripe seedless pumpkins or seeds were obtained on place, in local markets, from fruits currently destined toward human consumption. The fruits were carefully washed with tap water, then dried with papers, and afterwards cut to extract the seed, then dried in an oven with forced circulating air to prepare pumpkin meals from these two types of materials. Proximal analyses in the samples were conducted by duplicate following the AOAC (1990) recommendations. Seedless pumpkin meal and pumpkin seed meal were assayed by quadruplicate for in vitro (pepsin/pancreatin) DM, organic matter and N digestibility following the method of Dierick et al (1985). Reagent quality casein and soybean meal were used as standards for comparison purposes. All data were subjected to analysis of variance according to a one way classification (Steel et al 1997). The Harvey (1990) software was employed for data computation.

RESULTS AND DISCUSSION

Seedless pumpkin in natura contained less DM ($P<0.05$) than pumpkin seeds meal (table 1).

Table 1. Chemical composition of seedless pumpkins and pumpkin seeds (per cent in dry basis)

	Seedless pumpkins	Pumpkin seeds	SE ±
n	4	4	-
Dry matter	9.95	50.5	4.56*
Ash	13.06	4.18	2.24*
Organic matter	86.94	95.82	3.34*
Crude fibre	13.00	20.15	3.01**
Ether extract	5.12	10.50	1.15**
NFE	56.97	9.22	5.40*
Nx6.25	11.85	55.95	2.32**

* $P<0.05$; ** $P<0.01$

It was found that seedless pumpkins and pumpkins seeds differed in all its Weende components. Ash content in pumpkin seeds was near on third ($P<0.01$) to that found in seedless pumpkins, and therefore, the reverse was true for organic matter ($P<0.05$). In the case of crude fibre, ether extract, and crude protein (Nx6.25) values, the seeds were higher in content of these compounds as compared with seedless pumpkins. In consequence NFE values in seedless pumpkins was higher ($P<0.05$) than in the seeds.

Overall, the chemical composition of pumpkin seeds and fruit is in accordance to other previous results reviewed by Göhl (1981), and to Barrios et al (2004) who offered fresh entire pumpkins to fattening pigs. In this connection, Devendra and Göhl (1970) reported similar values for pumpkin samples collected in the Caribbean basin. In this connection, ether extract-free pumpkin seeds have been reported to contain 47.4 and 22.85% for crude protein and fibre, respectively (Manjarrez et al 1976), therefore supporting data reported herein for intact pumpkin seeds, which were found to be high in these type of products.

In vitro (pepsin/pancreatin) digestibility of DM and organic matter of seedless pumpkin revealed to be superior ($P<0.01$) to that of pumpkin seeds (table 2). These results are a consequence of the high crude fibre content of the seeds (table 1). The reverse was true for N utilization ($P<0.05$). Apparently, there are no so much previous reports concerning in vitro digestibility values for pumpkin products. Zdunczyk et al (1999) observed that protein digestibility of pumpkin seeds was similar to that of soybean meal (near 83%). These figures are in line with the data obtained in the current investigation.

Table 2. In vitro (pepsin/pancreatin) digestibility of pumpkin products

	Digestibility, %		
	DM	Organic matter	N
n	4	4	4
Casein	99.55 ^a	99.50 ^a	97.41 ^a
Soybean meal	85.86 ^b	86.08 ^b	80.43 ^b
Pumpkin			
Seedless	80.14 ^b	81.14 ^b	70.07 ^c
Seeds	70.10 ^c	77.75 ^c	85.44 ^b
SE ±	2.66**	3.08**	4.54*

* $P<0.05$; ** $P<0.01$

^{abc} Means without letter in common in the same column differ significantly ($P<0.05$) among them

Göhl (1981) has reviewed the subject of pumpkins and squash for feeding pigs, and has suggested that, although in some opportunities the plant is planted as a relish for animals, the fruits have a low content of dry matter, and in consequence, of nutrients. As a result, Göhl (1981) has suggested that pumpkins are of little value for pig feeding. On the other hand, it has also stated that pigs have difficulty for digestion of seeds, and therefore, the kernel should be removed from fruits and then used for feed after shelling.

According to the results presented herein, it could be of interest to find out methods to increase the feeding value of pumpkin products for feeding pigs, due to the high nutritive value of either seedless pumpkins or pumpkin seeds.

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REFERENCES

- AOAC. 1990. Official Methods of Analysis. Association of Official Agricultural Chemists (15th edition). Washington, District of Columbia, pp 980
- Barrios, A., Quintero, A., Trómpiz, J., González, D., Urdaneta, M. y Miranda, M. 2004. Uso de la auyama (*Curcubita maxima*) en la alimentación de cerdos. Etapa de engorde y características de la canal. *Revista Científica de la Facultad de Ciencias Veterinarias, Universidad del Zulia (FCV/LUZ)*, 6:89-94
- Bressani, R. and Arroyave, R. 1963. Essential amino acid content and protein value of pumpkin seed (*Curcubita favinosa*). *Agricultural and Food Chemistry*, 11:29-33
- Corzo, M., Ventura, M., Bravo, R.R., Trómpiz, J., González, D. y Padrón, S. 2004. Efecto de diferentes niveles de restricción de alimento balanceado sobre el consumo de auyama (*Curcubita maxima*) y el comportamiento productivo en cerdos en la etapa de engorde. *Revista Científica de la Facultad de Ciencias Veterinarias, Universidad del Zulia (FCV/LUZ)*, 14:419-423
- Devendra, C.C. and Göhl, B. 1970. Chemical composition of Caribbean feedstuff. *Tropical Agriculture (Trinidad)*, 47:335-340
- Dierick, N., Vervaeke, I., Decupeyre, J. and Henderickx, H. 1985. Protein digestion in pigs measured in vivo and in vitro. In: *Digestive Physiology in the Pig* (A. Just, H. Jorgensen and J.A. Fernández, editors). 580 Beretning fra Statens Husdybrugsforsøg. Copenhagen, p 329-332
- Douglas, J.H. and Dagher, N.J. 1987. Buffalo gourd seed in broiler starter rations under different dietary regimes. *Poultry Science*, 66:1371-1378
- Göhl, B. 1981. Feed Information. Summaries and Nutritive Values. *FAO Animal Production and Health Series N° 12*. Rome, pp 529
- Harvey, W.R. 1990. Mixed model least squared and maximum likelihood computer program (PC2 version). Ohio State University Press. Columbus, pp 91
- Ly, J. 1993. The role of monogastric animal species in sustainable use of tropical feed resources. In: *VII World Conference of Animal Production*. Edmonton, 1:95-17
- Ly, J., Carón, M. and Delgado, E. 1999. A note on in vitro digestibility of sweet potato tubers (*Ipomoea batata* Lam) L.) for pigs. *Cuban Journal of Agricultural Science*, 33:179-181
- Ly, J. and Delgado, E. 2005a. A note on in vitro (pepsin/pancreatin) digestibility of taro (*Xanthosoma sagittifolia* spp) and cocoyam (*Colocasia esculenta* spp) for pigs. *Revista Computadorizada de Producción Porcina*, 12:90-92
- Ly, J. and Delgado, E. 2005b. Digestion of bananas and plantains in pigs. In vivo ileal digestibility of diets based on green fruits. *Revista Computadorizada de Producción Porcina*, 12:204-209
- Manjarrez, B., Enríquez, F., Avila, E. and Shimada, A.S. 1976. Sustitución de pasta de soya por pasta de semilla de calabaza en raciones para cerdos. *Técnica Pecuaria en México*, 31:39-41
- Murillo, D.R. 1984. Utilización de la calabaza (*Curcubita ficifolia* D.) y distintos niveles de restricción de balanceados en la alimentación de cerdos mestizos en crecimiento y acabado. Tesis de Ingeniero Zootecnista. Escuela Superior Politécnica de Chimborazo. Riobamba, pp 47
- Rodríguez, S. and Mendoza, C. 1966. Notas sobre el Cultivo de la Auyama. Ministerio de Obras Públicas. Caracas, pp 38
- Steel, R.G.D., Torrie, J.H. and Dickey, M. 1997. Principles and Procedures of Statistics. A Biometrical Approach. McGraw-Hill Book Company In Company. New York, pp 666
- Zdunczyk, Z., Minakowski, D., Frejnagel, S. and Flis, M. 1999. Comparative study of the chemical composition and nutritional value of pumpkin seed cake, soybean meal and casein. *Nahrung*, 43:392-395
- Zucker, H., Hays, V.M., Speer, V.C. and Catron, D.V. 1958. Evaluation of pumpkin seed meal as a source of protein for swine using depletion-repletion technique. *Journal of Nutrition*, 65:327-333