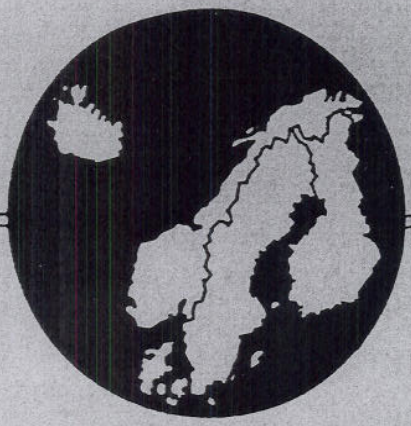

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DIGESTIBILITY OF PROTEIN AND ENERGY AND PROTEIN VALUE OF SOME ROUGHAGES FOR GROWING SWINE

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Abstract

The present investigation was undertaken to study the the faecal digestibility of dry matter, organic matter, protein and fibre for growing pigs fed on a high level of roughage. The three roughage types studied were clovergrass, clovergrass silage and wholecrop pea-barley silage. The study was conducted in two experimental periods (exp 1 and exp 2). In each experiment 10 crossbred female pigs (5 x 2 littermates) were divided into two groups fed either fresh clovergrass or frozen and thawed clovergrass (exp 1) and either clovergrass silage or wholecrop pea-barley silage (exp 2). All the pigs were in addition fed 1 kg of a basal diet daily. The pigs were adapted to the diets for 30 and 29 days in exp 1 and 2 respectively followed by a 7-day collection period. The average liveweight of the pigs at the first day of collection was 42,8 kg (SD 2,2) and 39,5 (SD 3,8) in exp 1 and 2 respectively. The daily weigh gains (g/d) of the pigs in the collection periode were 519 (SD 122), 562 (SD 77), 362 (SD 119) and 258 (SD 104) for pigs fed fresh clovergrass, frozen and thawed clovergrass, wholecrop pea-barley silage and clovergrass silage respectively. The roughage intake formed 19.3, 18.3, 19.0 and 18.2 % of total DM intake for pigs fed fresh clovergrass, frozen (and thawed) clovergrass, wholecrop pea-barley silage and clovergrass silage, respectively. There was found no significant effect of freezing clovergrass on the OM or protein digestibility of clovergrass. Furthermore, the protein utilization appeared to be similar for all the pigs fed roughages.

Introduction

In Danish organic pig production one of the claims is that roughage must be available daily for every animal. To use roughage as a part of the daily feed ration, organic pig producers have a need to get some information about the energy value of roughage. At the Danish Institute of Agricultural Sciences, an ongoing project is to study the energy value of some high fibre feeds. The three roughage types studied are clovergrass, clovergrass silage and wholecrop pea-barley silage. A preliminary experiment was set up to study how big a portion roughage can be expected to make of the daily feed ration in controlled balance studies with growing pigs and to get preliminary results on the digestibility of the roughages. It was studied if there is any effect of storing the clovergrass at -20 °C on the digestibility compared to freshly harvested clovergrass. The former is preferable for the use in controlled balance studies. The faecal digestibility of dry matter (DM), organic matter (OM), crude protein (CP) and dietary fibre for growing pigs fed on a high level of the three roughage types were studied. Preliminary results from the pilot experiment are presented here.

Materials and methods

The study was conducted in two experimental periods (exp 1 and exp 2). In each experiment 10 crossbred female pigs (5 x 2 littermates) were divided into two groups fed either fresh clovergrass or frozen (and thawed) clovergrass (exp 1) and either clovergrass silage or wholecrop pea-barley silage (exp 2). All the pigs were in addition fed 1 kg of a basal diet daily. The pigs were adapted to the diets for 30 and 29 days in exp 1 and 2, respectively, followed by a 7-day collection period. In

the collection period the pigs were fed as big a portion of roughage as possible without too much feed residues. The average liveweight of the pigs at the first day of collection was 42,8 kg (SD 2,2) and 39,5 (SD 3,8) in exp 1 and 2 respectively. The digestibility of the roughages was calculated by the difference method from the digestibility of the mixed diet and a calculated value for the basal diet.

Results

The daily weight gains (g/d) of the pigs in the collection period were 519 (SD 122), 562 (SD 77), 362 (SD 119) and 258 (SD 104) for pigs fed fresh clovergrass, frozen (and thawed) clovergrass, wholecrop pea-barley silage and clovergrass silage, respectively.

The roughage intake was in percent of DM intake 19.3 (SD 1.9), 18.3 (SD 3.2), 19.0 (SD2.9) and 18.2 (SD 3.5) for pigs fed fresh clovergrass, frozen and thawed clovergrass, wholecrop pea-barley silage and clovergrass silage, respectively.

The chemical composition of roughages and the basal diet is presented in Table 1.

Table 1. Dry matter, ash, crude protein, starch and gross energy in clovergrass, wholecrop pea-barley silage (WCPB), clovergrass silage, and basal diet

	Dry matter %	Ash g/kg DM	Crude Protein g/kg DM	Starch g/kg DM	Gross Energy MJ/kg DM
Clovergrass	19	92	241	2.5	18.0
WCPB silage	32	61	118	186	19.0
Clovergrass silage	43	111	169	4.4	18.9
basal diet	90	59	226	396	18.9

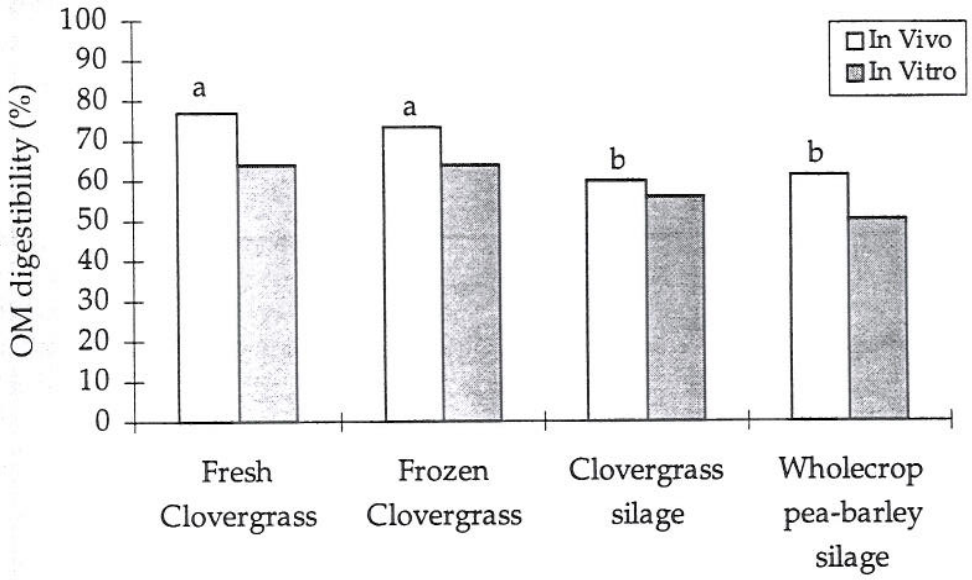

Figure 1. ***In vivo*** **and** ***in vitro*** **organic matter digestibility of clovergrass (fresh and frozen), clovergrass silage and wholecrop pea-barley silage. Different letters denote significant differences ($p<0.05$) between** ***in vivo*** **values (standard error = 7.5).**

The *in vivo* and *in vitro* OM digestibility of the three roughages is presented in Figure 1. The digestibility of fresh and frozen (thawed) clovergrass did not differ significantly. The wholecrop pea-barley silage and clovergrass silage had a lower OM digestibility compared to clovergrass (fresh and frozen). For all roughages the *in vivo* OM digestibility was found to be higher than the *in vitro* digestibility.

The *in vivo* and *in vitro* protein digestibility of the three roughages is presented in Figure 2. There were no significant differences in the protein digestibility of fresh or frozen (thawed) clovergrass. The *in vitro* digestibility of clovergrass silage and wholecrop pea-barley silage was higher than the *in vivo* digestibility unlike the clovergrass (fresh and frozen) where the *in vitro* digestibility was lower than the *in vivo* protein digestibility.

The utilisation of protein from the three roughages was found to be 63.6, 53.9, 56.4 and 62 % of digested protein for fresh clovergrass, frozen clovergrass, clovergrass silage and wholecrop pea-barley silage, respectively. The differences in protein utilization were not significant.

Discussion

The *in vivo* OM digestibility of the three roughages tended to be higher than the *in vitro* OM digestibility. An explanation for the discrepancy could be that the pigs were able to distinguish between the leaves and the stems and left the stems in the through. The *in vitro* digestibility of the leaves and stems from the clovergrass will be further studied.

The OM digestibility of whole crop pea-barley silage found in this study is in good agreement with the results of Lund *et al.* (1981) and Håkansson and Malmlöf (1984), who found OM digestibility's of 61-68 % for heat dried whole crop pea meal. However, the CP digestibility found in this study was 10-20% higher than the CP digestibility found by these authors. The OM and CP digestibility found for clovergrass in this study was higher by 20 and 35 %, respectively compared to the digestibility found on clovermeal in the study of Håkansson and Malmlöf (1984). The OM and CP digestibility found for clovergrass silage was higher by 30 and 45 %, respectively compared to the results of Just *et al.* (1983).

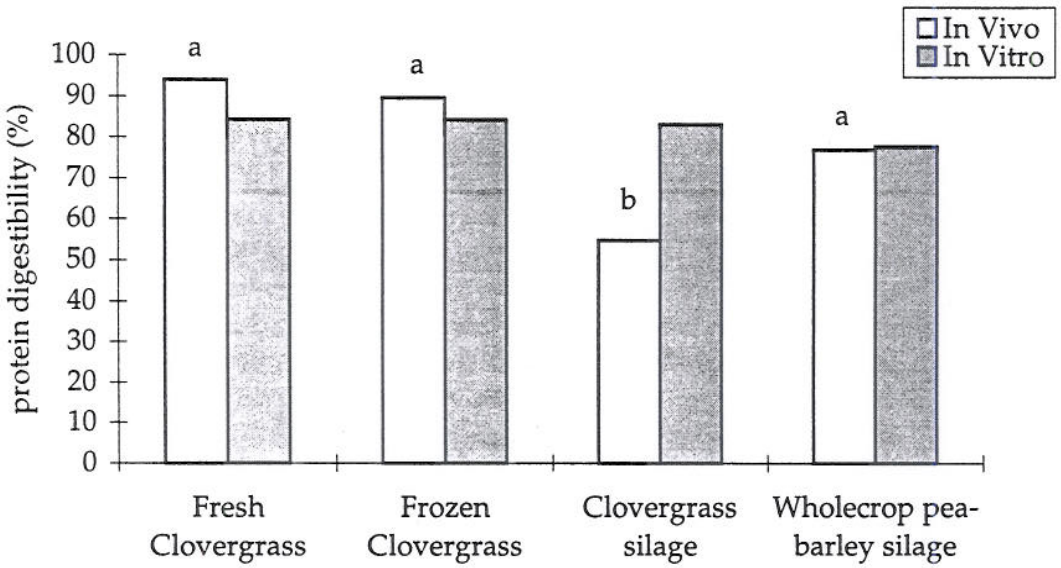

Figure 2. ***In vivo*** **and** ***in vitro*** **protein digestibility of clovergrass (fresh and frozen), clovergrass silage and wholecrop pea-barley silage. Different letters denote significant differences ($p<0.05$) between** ***in vivo*** **values (standard error = 22.5).**

Conclusion

There was no difference in the OM and protein digestibility of fresh or frozen (and thawed) clovergrass, thus it is possible to store the clovergrass at -20 °C before using it in balance studies as `fresh´ clovergrass.

The *in vivo* OM digestibility of the three roughages tended to be higher than the *in vitro* OM digestibility, maybe due to separation of the diet during ingestion.

The OM digestibility of clovergrass (fresh and frozen) was higher than the OM digestibility of clovergrass silage and wholecrop pea-barley silage. Protein from clovergrass and wholecrop pea-barley silage was digested to a higher degree compared to protein from clovergrass silage. However, the *in vitro* protein digestibility of clovergrass silage did not seem to be notable different from the *in vitro* protein digestibility of clovergrass and wholecrop pea-barley silage.

References

Håkansson, J. & Malmlöf, K. (1984). The nutritive value of grass-,clover- and pea crop meals for growing pigs. *Swedish J. Agric. Res.* **14**, 5-51.

Just, A., Jørgensen. H., Fernández, J.A., Bech-Andersen. S. & Enggaard Hansen, N. (1983). The chemical composition, digestibility, energy and protein value of different feedstuffs for pigs. 556 Report from the National Institute of Animal Science, Denmark

Lund, S., Håkonson, J. & Erikson, S. (1981). Nutritive value of whole crop pea for swine.(Swedish University of Agricultural Sciences, Department of Animal Nutrition, Report 57. 8 pp. S-750 07 Uppsala, Sweden.